Imperial Forest Research Institute,
Progress report,
1908-09 to 1912-13
(Except- 1910-11)

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ROGRESS REPORT

OF THE

IMPERIAL FOREST RESEARCH INSTITUTE

FOR THE YEAR

1908-1909. 1909-10, 1911-12 & 1912-13

(FOREST YEAR)

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FROM

A. M. F. CACCIA, ESQ., M.V.O., F.Z.S.,
President, Imperial Forest Research Institute,

To

THE INSPECTOR GENERAL OF FORESTS TO THE
GOVERNMENT OF INDIA, SIMLA.

Dehra Dun, the 29th September 1909.

SIR,

I HAVE the honour to submit herewith the progress report of the Imperial Forest Research Institute, for the forest year 1908-09.

I have the honour to be,

SIR,

Your most obedient Servant,

A. M. F. CACCIA,
President, Imperial Forest Research Institute.

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Progress Report of the Imperial Forest Research Institute for the Forest year 1908-09.

CHAPTER I.

ADMINISTRATION.

The post of President was held by Mr. L. Mercer, I.F.S., Conservator of Forests and Principal of the Imperial Forest College, from the commencement of the year until the afternoon of the 12th April 1909, when he proceeded on leave, Mr. A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., being appointed to act for him.

The following statement gives the names of the officers who held charge of the various branches of the Forest Research Institute during the year :—

Branch of the Forest Research Institute.	Dates.		Name of Officer in charge of branch.
	From	To	
Sylviculture	1st July 1908	30th April 1909	Mr. A. M. F. Caccia, I.F.S., M.V.O., F.Z.S.
	1st May 1909	30th June 1909	Mr. R. S. Troup, I.F.S., F.C.H.
Forest Zoology . . .	1st July 1908	30th June 1909	Mr. E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., F.R.G.S.
Forest Botany . . .	1st July 1908	30th June 1909	Mr. R. S. Hole, I.F.S., F.C.H., F.L.S., F.E.S.
Forest Economy . . .	1st July 1908	18th October 1908	Mr. A. J. Gibson, I.F.S., F.C.H.
	19th October 1908	5th May 1909	Mr. R. S. Troup, I.F.S., F.C.H.
	6th May 1909	30th June 1909	Mr. R. S. Pearson, I.F.S., F.L.S.
Forest Chemistry . . .	1st July 1908	30th June 1909	Mr. Puran Singh, F.C.S.

Every change in the officers holding charge of the various branches of the Research Institute of necessity seriously interferes with the research work. Such changes are especially to be deprecated at the present time when the Institute is in its infancy and the work and staff of each branch are imperfectly organized. A certain number of changes, *e.g.*, those due to officers going on leave, are inevitable; but these need not seriously interfere with the progress of work, especially when a suitable staff of assistants becomes available. With the object however of diminishing the possibility of unnecessary changes occurring, the question of placing research officers who have served a probationary period on a separate cadre is one which calls for early consideration.

CHAPTER II.

THE WORK OF THE RESEARCH INSTITUTE.

SECTION I—TUITION.

The officers of the Imperial Forest Research Institute are expected to devote a certain portion of their time to giving instruction in the subjects in which they are specialising. Courses of lectures are delivered to the students of the Imperial Forest College, and in addition the specialist may be required to give advice, instruction and other assistance to members of the Department or others, desiring to perfect themselves in any particular branch of Forestry, or who may wish to utilize the laboratories or to refer to the library and collections of the Institute. The time so devoted to education is certainly of the greatest utility both to the research officer himself and for the advancement of forestry in general. Not only does it enable others to benefit by the knowledge acquired by officers who are able to devote their whole time and energies to a particular branch of study, but it also undoubtedly keeps the

specialist himself up to date in his science. Far indeed from cavilling at the amount of time devoted to this object, every research officer fully recognizes the great advantages which accrue from an intimate connection between research and education; and it is hoped that as the work of the Research Institute becomes organized and better known, forest officers throughout India will take full advantage of the facilities which the Institute affords in this respect.

At the same time during past years research officers have, for various reasons, been frequently called upon to devote their time to elementary instruction, frequently in subjects totally unconnected with their own research and to supervising the conduct and discipline of the students on tour. In consequence, the progress of their legitimate work has been greatly retarded.

This question has, therefore, received careful attention. Definite proposals to the effect that the instructional work of each research officer should in future be restricted to the higher branches of his particular subject were submitted to the Government of India during the year.

The following table shows the time devoted by each research officer to educational work of the above description and to research work proper during the year under report:—

Designation of officer.	Time devoted to educational work.	Time devoted to research work proper.
	Number of months during 1908-09. (Forest year.)	Number of months during 1908-09. (Forest year.)
Forest Zoologist	6	6
Forest Botanist	8	4
Sylviculturist	7	5
Forest Economist	7	5
Forest Chemist	4	8

The President of the Forest Research Institute is also the Principal of the Imperial Forest College. As Principal of the College he is charged with the general administration of the Institution, including the regulation of the course of studies (subject to the sanction of the Government of India); the supervision of all buildings and gardens, which are utilized either by College or Research officers; and the control and conduct of connected accounts and correspondence. On the other hand, as President of the Research Institute he is required to supervise all the research work of the Institute and to conduct all correspondence in connection therewith.

An endeavour has been made to keep these two posts separate in the past: but in view of the remarks made above regarding the inexpediency, especially under existing conditions, of wholly separating research and education, it is thought that the best results would be obtained by combining the two posts; a step, which would by preventing much of the duplication of work at present existing at once lead to greater efficiency.

Section 2.—Investigations and Research.

Sylviculture and Working-Plans.

The progress of pure research in the sylvicultural branch of the Research Institute has been considerably delayed owing to no definite decision having so far been arrived at as to the scope of the work appertaining to that branch and the methods to be followed in carrying it out. During the past three years an endeavour has been made to obtain results by leaving all experimental work, and the collection of all facts and figures to the local forest officers. The Sylviculturist has only been permitted to pay casual and hurried visits to certain forest areas with the object of starting inquiries into definite problems: but thereafter he has been required to leave the collection of the necessary data, and the laying out of experimental areas and the conduct of the requisite experiments entirely to local officers. Needless to say, this procedure has been found to be wholly unworkable. District Forest Officers are already overburdened with administrative duties, and however willing they might be to help, the press of other duties has absolutely prevented their undertaking the conduct of experimental work, which would invariably require their constant attention and presence, and the continuous collection and recording of data. On the other hand, without such experiments research cannot advance. This fact has now been fully recognized by the officers of the Research Institute and by the Department in general; and towards the end of the year proposals were submitted whereby the *whole* of the work connected with sanctioned sylvicultural investigations is to be carried out by the Research Institute. These proposals necessarily imply an increase in the sanctioned establishment of the Sylvicultural branch of the Research Institute: additional

officers being required to assist in experimental work and in the collection of the necessary statistics : but this is inevitable if any progress is to be made in this most important branch of forest research. It is evident also that with a considerable increase in the number of experimental areas and with investigations extending into various Provinces it will become impossible for a single research officer to satisfactorily control the work. The necessity of appointing qualified Provincial experts is a question which them demands consideration, and towards the close of the year proposals were submitted for the appointment of a special (Provincial) Research Officer to initiate investigations into the various important sylvicultural questions calling for immediate enquiry in the Province of Burma.

As a corollary to the above it follows that the sylvicultural research work of the year had necessarily to be restricted largely to the collection and compilation of available information, little or no provision being made for original research work. The chief subjects thus brought under investigation during the course of the year may be summarised as follows :—

The preparation of yield tables for various species under some definite system of treatment.—Information for the compilation of yield tables is being collected regarding *Babul* (Acacia arabica) in Berar ; *Sissoo* (Dalbergia Sissoo) plantations at Changa Manga, Punjab ; *Eucalyptus* plantations at Ootacamund ; *Casuarina* plantations in Madras ; and *Teak* plantations at Nilambur, Madras. But here again the progress of the work was greatly hampered owing to the Imperial Sylviculturist not being permitted to himself collect the required data. Assistance (as much as lay within their powers) has, however, been freely given and promised by the local forest officers.

The selection method of treatment and the uniform method of successive regeneration fellings as applicable to Indian forests.—A comprehensive note on the selection system in Indian forests as prescribed by existing working-plans based on that system, together with a short description of some Continental methods, was prepared and published during the year. Some information was also collected regarding the Uniform method, with special reference to its application in a modified form in Indian forests, and a note will shortly be published.

The collection of information regarding plantation work carried out on a large scale.—A considerable amount of information has been collected on this subject during the course of the year, particularly as regards agri-sylvicultural operations and the planting of arid lands and shifting sands, and short visits were paid to some of the most important of these works. The information so collected will after collation be published.

The collection of statistical data.—Statistical data have been collected as far as possible for the Sal, and these have been published as Forest Pamphlet No. 8, Working Plan Series No. 2 ; similar data relating to the teak and to the Chir pine (*Pinus longifolia*) have also been brought together. Further, with the object of introducing a uniform procedure for the whole of India, and of thus ensuring experimental work being carried out and directed on identical lines, a set of standard rules for collecting statistical data regarding the development of the principal timber trees or crops in India was drawn up and published during the year.

The collection of sylvicultural notes relating to various species.—As a result of the short tours made in various forests, some progress was made in the collection of information under this head: but such notes must necessarily be verified and corroborated by experimental work and further study in the forest.

The height at which bamboos should be felled and the effect of the season of the year.—An experiment was started by the Divisional Officer, Siwalik Division, United Provinces, with the object of investigating whether in bamboo fellings the culms should be cut above or below the first node. In accordance with the principle noted above that all research work must be conducted by Research Officers themselves it is now proposed that the Imperial Sylviculturist should take over charge of this experimental area, together with any others it may be thought necessary to establish, and to combine with the above investigation, an inquiry (suggested by the Government of Madras) as to whether the felling of bamboos on dark nights has any influence on the durability of the culms.

Forest Botany.

The following subjects were included in the research programme sanctioned for the year under report :—

(*a*) Study of Teak coppice and reproduction.

(*b*) Study of Forest grasses, with special reference to the effects of fire upon them.

(*c*) Study of the various species, or forms, of *Grewia* of economic importance, with special reference to the production of a satisfactory classification and description of the same.

As regards the first subject some of the notes and observations collected by the Botanist in the Central Provinces during the previous year were worked up and the results sent to the Press for publication in the form of a Pamphlet. The results obtained indicate that, contrary to a widely spread opnion, the coppicing of teak towards the close of the period of vegetatine activity in September and October is not injurious. This probably applies also to the case of many other deciduous species and is a matter of considerable importance, for the prohibiting of all fellings during the rainy season has frequently resulted in a considerable loss of revenue.

Another important point noticed, which, however, requires further investigation, is that felling low in the season of vegetative rest is apparently responsible for the frequent death of stools of important deciduous species and that if coppice fellings must be carried out (as they usually are) during the resting period, cutting high appears to be frequently desirable.

The fertility of the seed produced by coppice shoots is another question of great importance which received attention. At the close of last year Mr. McCrie, I.F.S., F.C.H., sent the Botanist a sample of undoubted teak coppice seed which he had collected himself from 9-year old coppice shoots in the Saugor Division of the Central Provinces. The seed was sown at the Research Institute in July 1908 and it germinated towards the close of the year under report and produced healthy seedlings. The fact has, therefore, been proved that teak coppice shoots of only 9-years growth are capable of producing good fertile seed. The age at which coppice shoots produce seed of course depends to a great extent on the age of the mother tree felled and the nature of the stool.

The study of forest grasses was commenced for the first time during the year under report, this matter being one which for several reasons urgently requires attention. In many localities, for instance, the question of supplying sufficient fodder from the Government forests for the steadily increasing number of cattle which have to be accommodated is one of great difficulty. This problem may no doubt be temporarily solved in various ways but it seems certain that the Forest Department will ultimately be required to increase the quantity and improve the quality of the grass produced in its grazing areas so far as is practicable. At present practically nothing is done in this respect and very little is known regarding the conditions necessary for the successful growth and reproduction of the most valuable fodder grasses, in consequence of which attempts to propagate them frequently end in failure. Many grazing areas also are annually allowed to be burnt over although practically nothing is known regarding the injurious effect of such firing on the most valuable grasses.

On the other hand the question of the relations existing between our important forest trees and the grasses usually associated with them is a question greatly in need of study. While some species of grasses are valuable on account of their power of fixing unstable soil and of improving the quality of the soil, thus preparing the way for tree growth, others by their severe competitive action interfere with and may altogether prevent tree production. Want of exact knowledge regarding these points frequently leads to erroneous conclusions, *e.g.*, that the absence of tree reproduction in particular grassy areas is due to the presence there of certain grasses, whereas these grasses may owe their existence in such a case to some factor such as soil or frost which prevents tree growth coming in and killing out the grasses.

This systematic study of our forest grasses, therefore, may be expected not only to supply the necessary information which will enable us to successfully favour the growth and reproduction of any grass of special economic value but in addition, by indicating the factors responsible for the absence of tree growth from grassy areas, will materially help in the restocking of such areas with valuable tree species. Incidentally also, the detailed study of the various grasses in the field is of great taxonomic value, giving as it does a correct idea of the limits of the various species and thus helping to check the conclusions arrived at by systematists who have worked mainly with herbarium material.

During the year under report it was only possible to make a very small beginning with this work. The Botanist made a short tour in the Siwalik Forest Division during the period November 1908 to January 1909 but as he was also in charge of the College students on tour during November-December 1908 very little time was available for research.

Attention was mainly confined to nine important local species which are widely distributed in Sal forests and careful notes were collected in the forest in as many localities as possible regarding the conditions under which the various species grow well in nature, the effect of fire upon them, the power of the different species to improve the soil and other points.

The information collected has, it is believed, satisfactorily established the following facts of interest, among others :—

(*a*) The damage done by fire depends mainly on the character of the soil, the season at which the fire occurs and the species of grass. Firing by no means necessarily kills out delicate and valuable fodder grasses and favours the growth of coarse-growing species. Cases have been seen where fire has had precisely the opposite effect; and species which produce delicate annual culms are often very resistant to fire damage.

(*b*) Some grasses indicate with great accuracy whether a certain soil is or is not suitable for the growth of valuable trees like Sal, and their appearance in forest blanks tells us whether we can reasonably hope to successfully stock such areas with a particular tree species or not.

In order that Forest Officers generally may be able to avail themselves of any useful results which are obtained from time to time it is essential that they should be able to recognise the grasses concerned. In order to facilitate the identification of the species dealt with therefore it is proposed to publish, together with the results obtained, full descriptions and illustrations of the different species. Incidentally also this will enable Forest Officers to check the conclusions arrived at with their own observations and will lead to the accumulation of additional information.

All the species at present under study were planted in the Experimental Garden at Dehra Dun during the year in order that their development might be watched and the differences of growth observed which are exhibited by burnt and unburnt plants respectively. It is also obviously advisable that all conclusions based only on observations made in the forest should so far as possible be checked by experimental cultivation.

No publication was possible during the year partly on account of insufficient time being available for the preparation of the detailed descriptions and drawings of the different species and partly owing to the advisability of observing one complete season's growth before publishing.

As regards the subject of *Grewias* although the results are not yet ready for publication it seems advisable to give here a brief review of the work which has been undertaken and of the lines on which it is proceeding, seeing that this subject of research has been under study now for two years, but, in considering the progress made, the fact must not be lost sight of that very little time has been actually available for research work during this period.

The study of this genus, the existing classification of which is very unsatisfactory and the synonymy of which is in great confusion involves three distinct classes of work, as follows :—

(*a*) The accurate determination of the original types which are the authority for existing names and of the date of their effective publication.

(*b*) The careful study of the various forms in the field in order to determine the extent to which the various types keep constant in nature, the extent and nature of the variations both normal and abnormal exhibited by these types in different localities and especially in order to investigate so-called "intermediate forms" and the extent to which the occurrence of such intermediates can be held to justify the combination of different types into one and the same specific group.

(*c*) The preparation of descriptions and illustrations of the various specific and varietal groups which study in the field, as checked by the careful examination and dissection of herbarium material, shows to be worthy of separate description and definition.

This study at present deals with 12 forms each of which has at one time or another received a separate specific name.

The united area of distribution of these forms covers practically the whole of India and Burma. To anyone acquainted with the confusion at present characteristic of the classification of this genus the magnitude of the work will be apparent especially as it involves at least a general acquaintance with all the forty odd Indian species of the genus in addition to the detailed study of the forms under special consideration.

The non-success also with which Indian botanists have for several years worked at this problem is a sufficient guarantee of its peculiar difficulty.

(*a*) *Determination of Types.*—Of the work defined above this is the portion which offers the greatest difficulty to workers in India owing to the fact that most of the types are stored in European Herbaria and that the publications containing the original descriptions are frequently not available in Indian libraries. In this part of the work therefore the co-operation of European Botanists is essential.

The great botanical interest of this genus however has of recent years induced botanists in both England and Germany to themselves undertake this work.

Considerable difficulty, therefore, has been experienced in obtaining the help necessary for this part of the study, partly because European workers naturally wished to obtain and keep for the purposes of their own research as much information as possible and partly on account of a general tendency to consider that a successful study of this genus could not be undertaken in India, owing to want of the necessary literature and the impossibility of obtaining access to most of the type specimens.

Believing however very strongly that a careful study of the species in the forest is absolutely essential for successful work in this genus the Botanist addressed the Director of Kew on the subject during the year. Fortunately for the work the Director accepted the point of view then advanced.

On this reference Dr. Stapf, Keeper of the Kew Herbarium, wrote as follows :—

"Field work on the lines laid down by Mr. Hole is of great importance as a supplement and corrective for Herbarium work which is apt to suffer through becoming too narrow and detached from the actual conditions of plant life", while the Director of Kew remarked "With Dr. Stapf's remarks I entirely concur. We shall be glad to do whatever is in our power to assist you with photographs or drawings of types or with co-types, where types are in existence or co-types are available".

The greatest help was accordingly received from the authorities at Kew during the year in the shape of authentic drawings and descriptions of type specimens without which this research could not have been successfully carried on.

The Forest Botanist has also to acknowledge the receipt of several valuable photographs of types most generously sent to him by Mr. H. H. Haines of the Forest Department while he was on leave in England. Thus, although actual access to the types would of course have been

desirable, if it had been possible, it is believed that this portion of the work is being satisfactorily dealt with.

(*b*) *Field work.*—As regards this division of work it is unfortunate that the College educational duties do not permit of extended tours being undertaken for the purpose of studying the various forms in the forest. The opportunities for touring which have been available however have been utilized as far as possible by confining attention mainly to those areas where various types come into contact.

Thus during the year under report the connection beween the forms know in Northern India as *Grewia elastica*, Royle, *Grewia, vestita*, Wall., *Grewia leptopetala*, Brandis, *Grewia asiatica*, Linn, and *Grewia sapida*, Roxb., was carefully studied in the Siwalik and Jaunsar Divisions while during the previous year the connection between *Grewia tiliæfolia*, Vahl, *Grewia leptopetala*, Brandis, and *Grewia elastica*, Royale, was studied on the Satpuras in the Central Provinces.

This field work, limited though it has been, has proved of the utmost value and by giving a correct idea of the variations of certain forms in different localities it has, it is believed, laid a sound basis for the study by analogy of other forms received from localities which it has not been possible to visit.

The fact that tours must occasionally be made at unsuitable seasons of the year when satisfactory specimens of flowers and fruit are not available is a drawback, but selected trees have been numbered and marked in different localities in the Jaunsar and Siwalik Divisions and specimens are collected from these marked trees at different seasons of the year.

(*c*) *Herbarium-work.*—In addition to the great advantage of being able to personally study many of the species in the forest in different localities and at different seasons, the Botanist has been able to assemble, largely owing to the help of other Forest Officers, a practically unique collection of herbarium specimens of the species under study. As an indication of the extent of this collection and of the readiness with which Forest Officers in various parts of India and Burma have helped and are helping this research it is sufficient to note that in addition to collections made by the Botanist himself, valuable specimens were received during the year from the following :—

United Provinces.—Divisional Forest Officers, Bundelkhand, Garhwal, Bahraich and Gorakhpur.

Central Provinces.—Mr. C. G. Rogers, Conservator of Forests, Berar, sent a most valuable set, while others were received from Divisional Forest Officers, Chikalda, Nimar, Hoshangabad and Balaghat.

Madras.—Divisional Forest Officers, South Salem, North Arcot, Coimbatore, Upper and Lower Godavari, Tinnevelly and Anantpur.

Bombay.—Conservator of Forests, Sind Circle, and Divisional Forest Officers, Jerruck, Satara and Belgaum.

Baluchistan.—Extra Deputy Conservator of Forests in charge.

Bengal.—Divisional Forest Officers, Tista and Sonthal Parganas.

Eastern Bengal and Assam.—Divisional Forest Officer, Buxa.

Burma.—Divisional Forest Officers, Arakan, Tharrawaddy, Mandalay, Myittha, Henzada, Bhamo and Prome. Mr. J. H. Lace, Chief Conservator of Forests, also very kindly sent a valuable set of specimens collected by himself.

When this work is completed the help given by the various officers will be acknowledged individually, and at present the Botanist desires to express his thanks to the Chief Conservators and Conservators of the provinces enumerated above and the District Officers mentioned and especially to Mr. Lace and other Burma Officers for specimens of forms which are at present very imperfectly known. The majority of the specimens received are of peculiar value consisting as they do of extensive series of specimens collected at different seasons from the same tree and accompanied as they are by valuable notes.

In most cases specimens of the wood and bark have also been sent thus enabling the wood of the various species to be accurately described.

In addition to these collections belonging to the Research Institute the Superintendent, Royal Botanic Garden, Calcutta, most kindly sent the Botanist during the year all the sheets of *Grewia* belonging to the General Herbarium of the Botanic Gardens for examination. The greatest help has also been given during the year by Captain Gage, Superintendent, and Mr. W. W. Smith, Curator of the Herbarium, of the Royal Botanic Garden in the way of supplying authentic copies of drawings and descriptions of types and other information asked for. Mr. I. H. Burkill, Reporter on Economic Products to the Government of India, also very kindly sent the Herbarium collection of *Grewias* belonging to his office during the year for examination.

The final work of preparing the detailed descriptions and illustrations of the various groups which study up to date shows to require separate description and definition was commenced at the close of the year and the entire results of this research will it is hoped be published next year.

Forest Officers in the Punjab and Madras were assisted with advice regarding the method of conducting local forest experiments and a plan of work was drawn up during the year for the conduct of an experiment regarding the movement of marks on tree stems which is being carried out by local Forest Officers in Madras.

Forest Economy.

The various inquiries and investigations carried out by the Imperial Forest Economist during the year under report being of a varied nature, the progress made under the several heads may best be tabulated as follows :—

Serial No.	Subjects under investigation.	Progress and results.
1	Trial of woods suitable for matches . .	The enquiry under this head was completed, and constituted one of the most important works carried out during the year under report. The investigation being of an important character, it is dealt with in a separate paragraph of this report.
2	The Commercial value of lac . .	This enquiry was transferred in part to the Imperial Forest Chemist, who is making a special study of the preparation of shellac. Certain important results have been obtained by that officer, (*vide* the section dealing with forest chemistry), and it now remains to ascertain the commercial value of the shellac prepared by his new process; and this is now receiving attention.
3	The antiseptic treatment of timbers, especially for railway sleepers.	The timbers of various species after being treated by the Powell process, with "Ligno preservative," "Avenarius Carbolineum," "Atlas" and "Jodelite" solutions, were laid down and kept under observation. The investigation is proceeding. Arrangements have also been made to carry out an experiment on a practical scale with a large number of sleepers treated by the Powell process. These are to be laid down by the Railway Board and their life history recorded.
4	Utilization of various oil-seeds from forest trees.	A variety of seeds were collected and sent both to the Imperial Forest Chemist and to a London firm for analysis. If the oil obtained from any of the seeds promises to be of commercial value, an enquiry will be instituted as to the amount of seed available and at what rates it can be put on the market.
5	Utilization of *Xyliadolabri formis* for paving blocks.	A portion of street has recently been laid down in Rangoon with the wood of this species, but as yet no opinion can be formed as to its suitability. Further it is stated that all the Burma "pynkado waste" in saw mills is being cut into scantlings which find a ready market, thus reducing the value of the experiment.
6	Trial of woods for pencils . . .	Several woods are now being tested by two Indian firms; but no definite results have so far been communicated to this office. They are expected shortly.
7	Trial of woods for cricket bats . .	A Calcutta firm has been supplied with certain woods for trial, but owing to the delay in seasoning, no results are as yet available.
8	Trial of woods for archery . . .	Wood samples of *Taxus baccata* were sent to the Royal Company of Archers, Edinburgh, for trial as to their suitability for the manufacture of bows, and were most favourably reported upon. The small annual quantity required by the Company and the difficulty of extraction and the amount of supervision required will probably make it unprofitable to take up the contract.
9	Woods suitable for tea boxes . . .	Shooks for tea-boxes have been prepared in Burma from certain species, and sent to a large tea-planter in Assam for trial. His report is awaited.
10	Economic value of camphor obtained from *Blumea balsamifera*.	Raw material has been received from Burma. The Forest Chemist is experimenting with various types of stills, and on samples of the camphor being received from him the question will be studied from an economic point of view.
11	The cultivation of *Podophyllum Emodi* .	The cultivation of Podophyllum Emodi was continued on an experimental scale in Jaunsar, both in the nursery and in the forest, while the development of seedlings was studied at Dehra Dun. Further experimental work is necessary before any definite conclusions can be arrived at.

Serial No.	Subjects under investigation.	Progress and results.
12	The destructive distillation of wood . .	A still has been procured by the Imperial Forest Chemist and practical tests with selected timbers will shortly be undertaken.
13	Walnut "Burrs"	The possibility of obtaining useful veneers from walnut burrs is under enquiry: but no conclusion has yet been arrived at.
14	The utilization of gum-resins . . .	A collection of Indian gums and gum-resins has been sent to a firm for valuation. Several have been analysed and the report on others is awaited. No very definite information as to their economic value has yet been received.
15	Seasoning powers of various woods . .	Many varieties of woods have been taken under observation, but the woods are as yet insufficiently seasoned, so that no definite conclusions have been arrived at up to the present.
16	Wood-pulp of conifers	No real progress has yet been made in this branch of enquiry as the Imperial Forest Economist while on tour had to devote nearly all his time to students. Specimens of *Abies Pindrow* and *Picea Morinda* were sent to England, and Mr. Sindall reported favourably on both species. Exhibits of the pulp were sent to various Indian paper-mills who without committing themselves in any way, passed favourable remarks on the samples submitted to them for inspection. Experiments as to the possibility of floating these species down the hill-streams and the cost of the operations are now in progress.
17	Bringing to notice little known timbers, which deserve recognition.	The collection of data on six species namely:— *Dipterocarpus tuberculatus,* *Pterocarpus macrocarpus,* *Carallia integerrima,* *Diospyros Kurzii,* *Lagerstroemia tomentosa,* and *Berrya Ammonilla,* was completed. This enquiry being of importance is again referred to in a separate paragraph of this report.
18	*Schleichera trijuga* (Kossum) oil . .	Attempts have been made to put oil expressed from the seed of this species on the market. The attempt failed at first owing to the cost of collection, expression and railway freight being prohibitive. This difficulty has been partly overcome and it may be reasonably hoped that the experiment will now prove successful.
19	Utilization of fibres of *Sterculia villosa* and *Careya arborea.*	An attempt was made to place these fibres on the English market. The reports received on their quality have not, however, been favourable.
20	Trial of woods for pipes	Samples of woods of *Dalbergia latifolia, Acacia Catechu, Ougeinia dalbergioides, Cotoneaster microphylla* and *Rhododendron arboreum,* were sent to a European firm for testing; but owing to some of them splitting and others sweating, they were found unsuitable for the manufacture of pipes. Another consignment of Grewia spp., both stem and root-wood, has been sent, which may possibly be found suitable for this purpose.
21	*Prunus eburnea* seed	Attempts are being made to find a market for this seed. The enquiry is in progress.
22	Paving blocks for the Houses of Parliament in Japan.	On an enquiry made through a Home firm for paving blocks for the Houses of Parliament in Japan, specimens of various woods have been submitted for inspection: and the question is now pending.
23	Trial of woods suitable for opium-chests .	An attempt was made to send wood of Silver Fir and Spruce from the Punjab to the Opium Factory in Behar; but the cost of felling, extraction and railway freight was shown to be prohibitive. It is now proposed to carry out similar experiments with woods from Bengal.

Serial No.	Subjects under investigation.	Progress and results.
	Perfumes from the flowers of *Strobilanthes lupulinus.*	The flowers of this shrub were sent to a Home firm and were favourably reported upon; but owing to the consignment having arrived in a bad condition a further consignment is to be sent, so that no definite results are yet available.
25	Trial of woods suitable for brush-backs	Several species have been sent to a firm in Cawnpore; and a report on their suitability is awaited.

The most important investigation carried out during the year related to the match industry. The investigations under this head have now approached completion and a full report is about to be issued dealing more particularly with the following subjects, namely:—

(i) woods suitable for match sticks;

(ii) woods suitable for veneers for match boxes;

(iii) the available supply and distribution of suitable woods;

(iv) suitable sites for match factories;

(v) the financial aspect of the match industry; and

(vi) notes on existing match-factories.

From the enquiries and investigations made under these heads it may be safely stated that if the industry is run on strictly business lines it has a future in India. The main difficulty that presents itself is in connection with the supply of wood, for though the total amount available in the Government forests is plentiful, it is scattered over large areas, and it is therefore a moot point whether it will not be necessary in all cases to supplement the natural supply in part by plantations of suitable species.

An enquiry of considerable commercial importance was undertaken with the object of bringing to notice certain of the less known timber species, which are thought to deserve recognition, owing to particular inherent properties. Full particulars were collected relating to six species, and a series of short descriptive pamphlets were prepared, setting forth the various points of importance to the trade. The favourable reception given by the public to the publication already issued promises to justify the labour expended on this work.

The progress made in the enquiry as to the possibility of starting a wood-pulp industry in this country was much delayed owing to the Imperial Forest Economist being in constant attendance on the students of the Imperial Forest College while on tour. Experiments as to the possibility of floating Silver Fir and Spruce woods, suitable for the manufacture of wood-pulp, from the hills in the Jaunsar Division of the United Provinces were carried out, and a report on the results of these operations is awaited.

Experiments were also carried out by the Imperial Forest Economist in the Research Institute laboratories with a view to determine the following properties of a number of Indian woods, *viz*:—

(i) The variations in the specific gravity of wood during seasoning;

(ii) The tendency of woods to warp and split during seasoning;

(iii) The fissibility of wood when seasoned and unseasoned.

The last enquiry gave some valuable results, which have been embodied in the form of a pamphlet, now in the Press.

It has been shown that, contrary to European accepted ideas, Indian woods split more readily tangentially than radially.

The progress made in testing woods was very unsatisfactory. There is no suitable machine in the Research Institute for carrying out this branch of the work, so that arrangements were made with the Civil Engineering College, Sibpur, which possesses suitable workshops for carrying out the necessary tests. Owing to want of establishment and funds at the Engineering College the work stood in abeyance. Unless matters improve, the advisability of purchasing and erecting the necessary machinery at Dehra Dun will have to be seriously considered.

The enquiries received from officers of the Department and from private firms increased considerably, and are likely to further increase in the future as the Forest Research Institute becomes better known and as trade connections with Europe extend.

Forest Chemistry.

The work of the Forests Chemist is to a great extent intimately connected with that of the other branches of the Research Institute. He may be required to carry out chemical analyses of soils or to determine the manurial properties of leaves, etc., on behalf of the Sylviculturist or Botanist; or again he may be called upon to carry out investigations in conjunction with the Imperial Forest Economist: the former confining himself to the chemical and analytical aspect of the question, the latter to the economic which comprises

enquiries regarding the distribution, quantities available, cost of collection and extraction etc,, etc., as well as efforts to interest commercial firms in the same. Such combined work has the first call on the time of the Imperial Forest Chemist and it is only after the requirements of this work have been met that he is able to undertake independent investigations of a purely chemical nature.

The following is a brief account of the more important work carried out by the Imperial Forest Chemist during the year :—

Manufacture of Mangrove tannin extract.—The study of Mangrove and Sal tannins received considerable attention ; the object being to produce a marketable decolourised tannin extract from the highly coloured barks of the two species.

A sample of Borneo Cutch (or the Mangrove tannin extract manufactured in Borneo) which may be taken as the trade standard of perfection was received from the Imperial Institute, London, through the Inspector-General of Forests ; and the problem set before the Forest Chemist was to make the Mangrove extract manufactured at the Rangoon Government Tannin Factory as similar to the Borneo Cutch as possible. The latter gives a light buff coloured leather and is saleable at remunerative prices, while the extract manufactured from the same material at Rangoon imparts a very objectionable dark red colour to the leather, and has in consequence been pronounced unsaleable.

In studying this subject it was found essential to secure the co-operation of expert tanners in judging the quality of the extract prepared experimentally under different methods ; for no definite conclusion can be arrived at regarding the commercial value of an extract merely from its chemical analysis ; and in this respect, the Research Institute is indebted to Messrs. Cooper Allen & Co., Cawnpore, and also to Mr. G. Wense of the Agra Tannin Extract Factory for their valuable suggestions, and specially to the former firm for the help rendered in judging the quality of the tannin extracts prepared at the Research Institute.

The chief result of this investigation has been the successful decolourization of the Burma Mangrove tannin extract on a small laboratory scale. It was found that small pieces of hide tanned by the Mangrove extracts prepared by the Imperial Forest Chemist's new process in the Research Institute laboratory gave much better leather in point of colour and texture than that prepared from Borneo Cutch. Futher investigations with the process so discovered will now be carried out on a large scale in the Rangoon Factory, which is to be placed at the disposal of the Forest Chemist ; and it is proposed to send the samples of the manufactured extracts to different European firms for valuation. Should the results prove as successful as it is anticipated, it is thought that the new extract will lead to an important development of the tannin industry in India.

Extraction of Oil from Forest oil seeds.—About 150 different samples of Forest oil seeds of about 40 different forest species, received from different parts of India through the Imperial Forest Economist, were under examination during the year under report. The oil value of all of them was determined and further chemical examination of the different oils obtained is in progress. Experiments will also be made next year to press oil-cakes by means of a hydraulic press, and to determine the chemical composition of oil-cakes thus obtained. Much still remains to be done to complete this enquiry specially from an economic point of view ; and as already stated, the latter side of the investigation is being undertaken by the Forest Economist.

It is hoped that this enquiry will be completed during the course of the ensuing year.

The Manufacture of Shellac.—The experimental manufacture of Shellac on a fairly large scale is now in progress. The Shellac apparatus designed by the Forests Chemist (*vide* Indian Forest Memoirs, volume I, Part II), could only be got ready towards the end of May 1909. It was taken to Raipur, Central Provinces, and was there tried for the first time to demonstrate the Methyl alcohol process of manufacturing Shellac : but unfortunately many defects of construction were discovered in the machine, which had been made in the Roorkee Workshops.

As matters now stand, it would appear that Mr. Pooran Singh's Methyl alcohol process possesses great possibilities. On the other hand no definite conclusions can be arrived at, firstly, until the Shellac so obtained has been placed on the market and reported on by the trade ; and, secondly, until some large firm undertakes to take up the matter and to construct machinery on scientific principles and on a commercial scale. As regards the former desideratum steps are being taken to obtain trade opinion ; but as regards the latter, little can be done as yet, though an endeavour will be made later on to interest firms in this process.

The Distillation of Blumea balsamifera.—A final report on the distillation of Blumea balsamifera on a large scale could not be drawn up as it was found that the ordinary form of condenser failed to give satisfactory results. Various experiments had to be tried to so alter the form of the condenser as to suit the special requirements of Ngai camphor. Eventually a suitable form of condenser was designed and tried, and it gave very satisfactory results. The distillation of Blumea balsamifera is now being carried on in the laboratory and it is hoped that the Economist and the Chemist will shortly submit a joint report on the subject.

Turpentine oil and Colophony.—An enquiry into the distillation of turpentine oil, the clarification and decolourization of Indian colophony, and on the general prospects of the turpentine industry in India was undertaken by the Imperial Forest Chemist in conjunction with Mr. P. H. Clutterbuck, I. F. S. : the former officer devoting his attention more especially to

introducing improvements in the methods of manufacture; the latter dealing with the commercial aspects of the business. It is hoped that a joint note will shortly be published.

Bleaching Indian match woods.—Different processes of bleaching Indian woods, considered to be otherwise suitable for match-making, were tried. A short suggestive note was prepared and it will be published as an appendix to Mr. Troup's Memoir on "The Match Industry in India", now in the press.

Distillation of Khas (Vetiveria zizanioides) oil.—This oil is being distilled in the Research Institute laboratory, and the chemical examination of the oil is in progress.

Miscellaneous.—Other minor investigations carried out in the Forest Chemistry branch of the Research Institute included the analysis of Podophyllum roots and soils received from Chamba (Punjab) and Jaunsar (United Provinces); an investigation into the manurial value of the leaves, twigs, etc., of various shrubs, obtained from the Madras Presidency; the analysis of various soils sent from the Punjab; the distillation of Rusa grass oils; the determination of the calorific power of various Indian woods, etc.

Destructive distillation of wood.—No progress could be made during the year with the investigation of the destructive distillation of Indian woods. Estimates for a fairly large laboratory plant were under preparation, and this inquiry will receive attention during the ensuing year.

Forest Zoology.

The investigation into the insects damaging Sal and Conifers, which has been receiving attention from time to time, was advanced considerably during the year as a result of visits paid by the Imperial Forest Zoologist to the Sal forests of the Mandla Division, Central Provinces, and to the Kulu and Chamba hill forests of the Punjab. It may be interesting to briefly summarise the work carried out up to date under these two heads.

The distribution of the Sal may for descriptive purposes be divided into three belts or tracts: the Central India belt; the plains or Sub-Himalayan tract of the United Provinces; and the East Himalya tract, which includes Eastern Bengal and Assam, and the Darjeeling, Tista and Kurseong Divisions of Bengal. A study of the sal pests in the Central India belt of the species was commenced by the Forest Zoologist in Singbhoom, Chota Nagpur, between 1894—97 when the life history of the well-known longicorn beetle Hoplocerambyx spinicornis was partially worked out;* and during the year under report some further investigations were made in connection with insect pests infesting the Sal in the Central Provinces (Mandla Division).

Since 1900 when the post of Forest Entomologist was created considerable progress has been made with the study of the pests of the Sal belt of the United Provinces Terai and Oudh, amongst other discoveries of importance being the fact that the *Hoplocerambyx* of the Central Provinces and Chota Nagpur Sal belt is replaced in the United Provinces by the longicorn beetle *Aeslesthes holosericea*, which infests the Sal in a similar manner. A bark-boring pest of very considerable importance (*Spaerotrypes siwalikensis*) was also discovered to infest this belt. Between March to June 1905 a visit was paid to the Sal belt of Eastern Bengal and Assam, some acquaintance with the pests of which had been made in 1905—07 in the Kurseong and Kalimpong Terai and the Jalpaiguri Terai Sal areas. The visit to Assam established the fact that *Hoplocerambyx spinicornis* of the Central Provinces belt was present as a serious pest in Assam whilst the *Sphœrotrypes siwalikensis* of the United Provinces Terai was found to be replaced by a closely allied species in the Eastern Sal areas. These latter forests have long been known to undergo serious defoliation at varying intervals and it was also proved that young trees suffered severely from small wood-boring caterpillars (Arbela sp.) which tunnelled down the shoots of the branches and main stems and killed them. A similar but much smaller species is also present as a serious pest in the United Provinces Terai Sal areas. The Assam Sal investigations were published in a monograph as Forest Bulletin No. 11 (1908).

As we have seen the longicorn Hoplocerambyx is common to both the Central Provinces and Assam but is absent from the United Provinces. The bark-borer Sphærotrypes is however present in all the three Sal belts, but the species appear to be different in each.

Coming now to the defoliating caterpillars, careful experiments initiated in Mandla by Mr. A. P. Percival, the Divisional Officer, have established two important facts. Firstly, that the chief defoliators of the Central Provinces' forests differ both in species and genus and often in family from those of the United Provinces and Assam Sal tracts. Secondly, the experiments gave two generations of the life history of the most important Sal defoliator and considerable information about several others. They also established another important fact. The Central Provinces belt is also infested by a caterpillar shoot tunneller which infests the tree in a manner similar to the one found in the United Provinces and Assam but, so far as present observations go, the insect differs from either of these latter two. Great credit is due to Mr. Percival and his staff for the excellent and important piece of investigation work carried out by them between January and June of this year.

The last important feature of the Sal investigations relates to the seed. It has long been known that the seed of the tree is seriously infested by insect pests. The chief appear to be

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* *Vide* Injurious Insects of Indian Forests, page 71.

the caterpillars of minute moths. Those found in Assam differ entirely from the United Provinces species, whilst the Central Provinces insects differ again and form a separate group.

The investigations carried out in the Simla Catchment area Deodar Forests, with the assistance of the Conservator of Forests and the Divisional Officer, in connection with the bark-beetle infestations which appeared in that area in the spring of 1908 have resulted in determining the complete life histories of two pests previously known by their larvæ. During the year the life history of the insects, a Buprestid beetle (Chrysobothris sp.) and a longicorn beetle (Trinophylum cribratum), have been watched from the appearance of the beetle on the wing in the forest in June through the stages of egg, larvæ, nymph, to full grown beetle in the trees themselves, a most valuable piece of investigation reflecting great credit on the Punjab Officers.

During a tour in the Chamba State Forests in May and June and July, the Zoologist continued his investigations into the life histories of a number of Scolytid pests infesting the coniferous trees and was able to bring almost to completion his observations on the life history of the Spruce and Silver Fir *Chermes* which is closely allied to the Spruce pine apple gall-maker of the European coniferous forests. These observations on the coniferous insect pests of the Himalaya were commenced in May 1901 and the more important portions of the mass of material collected during the past nine years are being incorporated into a Memoir on the subject, parts of which have been already submitted to the President, Imperial Forest Research Institute.

Amongst minor investigation work may be mentioned the investigations being carried on into the predaceous and the parasitic pests of the Lac Insect, in which considerable help is being afforded by Mr. A. E. Lowrie, Deputy Conservator of Forests, Raipur Division, Central Provinces.

The attack of the longicorn root-borer *Coelosterna scabrata* in the Buldana plantations in Berar has been thoroughly worked out and much valuable information recorded by the Conservator, Mr. C. G. Rogers, and his Divisional Officers, whilst the same insect has been reported by Mr. T. Carr, as doing damage to the Babul at Kalpi in the United Provinces.

The operations initiated in 1905 to stamp out the serious bark beetle infestations in the Zhob Chilgoza forests in Baluchistan have been carried on with assiduity by the Political Agent, Colonel Chenevix Trench, and his assistant Captain James, year after year, and the forest is now reported as practically free of the beetles.

In Burma the investigations into the marine borers of teak and bamboo in the Pegu and Tenasserim Circles are continuing, whilst some valuable investigations are being carried out by Mr. Watson, into the longicorn borers of oak and other trees in the Southern Shan States.

Section 3.—Collections and Records.

Sub-section (a)—Museums and Collections.

The proper arrangement and up-keep of the various collections belonging to the Imperial Forest Research Institute and College form one of the most important duties of the officers of the Institute. It is evident that in addition to their educational value, such reference collections are indispensable to the Research Officers in dealing with their respective subjects. During the year under report considerable progress was made in bringing together and re-arranging the hitherto somewhat scattered collections.

Botanical Collections.—The Botanist took charge of the valuable Saharanpur Herbarium at Saharanpur on July 25th, 1908. The collections were forthwith removed to Dehra Dun and suitably housed there. When first taken over they were in considerable disorder, many of the sheets, including all those of *Grewia*, were missing and a large quantity of un-named material was included which required working up. Very considerable progress has, however, been made in arranging and putting the collections in order and this work will be completed early next year. The majority of the missing *Grewia* sheets have fortunately been recovered during the year from the Calcutta Herbarium, where they had been misplaced, and the remainder, together with other missing specimens are expected to be returned shortly from Mr. J. R. Drummond to whom they had been loaned.

The working up of un-named material, much of which is in bad condition and regarding which there is no information available as to name of Collector, Locality or Date, cannot be undertaken for the present, as whatever time can be spared by the Botanist for Herbarium work will for some time to come be most profitably employed in extending the collections by adding good material of important species which are either not yet represented or not adequately represented.

The work of amalgamating the Saharanpur collections with the Herbarium at the Forest College and Research Institute was commenced in April and the work will be completed early next year. This amalgamated Herbarium will certainly rank as the most important in India, next to the historic collections at Calcutta, and will form one of the most valuable assets of the Research Institute not only for research work, but also for the purpose of identifying specimens for Forest Officers and others, a work which hitherto could only be undertaken on a very small scale.

In addition to the *Grewia* specimens, which were received for research purposes and which will not be finally incorporated until the research is complete, 760 sheets were added to the Herbarium during the year. The most important contributions were from Mr. J. H. Lace and Mr. D. O. Witt, the latter sending duplicates of his Berar collections. Mr. A. W. Lushington also contributed an interesting set of specimens of root suckers of various species from Madras.

A valuable set of duplicates was received from the Calcutta Herbarium during the year, and in future it is proposed to extend this system of interchanging duplicates with other Indian herbaria.

Specimens were identified during the year for Forest Officers in Madras, Burma, Central Provinces, Andamans, Bengal and Punjab. It is hoped that the complete and valuable botanical collections now brought together at Dehra Dun, together with the botanical library will be freely made use of by Forest Officers throughout India and particularly by those who may undertake the preparation of local floras, or the study of particular branches of the subject.

In addition to the above the educational side of the question has not been neglected. A small reference herbarium is maintained for the use of the College students, and at the close of the year a collection was commenced with the object of exhibiting under glass, detailed specimens of plants of economic importance and of species illustrating the main sub-divisions of the Vegetable Kingdom and the most important natural orders of flowering plants.

Zoological Collections.—The Forest zoological collections have received considerable attention during the year. These consist of an index collection to accompany and illustrate in a practical manner the students' Manual of Forest Zoology; and also of valuable collections of forest insects some of which (including families more particularly characteristic of the forest, such as the Scolytidæ, Cerambycidæ, Buprestidæ, Bostrichidæ) are at present non-existent in collections outside those at Dehra. The latter are naturally of the greatest value for identification purposes and to those forest officers who may wish to make a special study of this branch of Indian forestry.

Forest Economy.—Towards the close of the year the specimens of Economic value, which had been collected together at the College, either in the Herbarium or in separate collections, were sorted and classified, and a commencement was made towards forming a purely Forest Economic Museum. The material so available has been found amply sufficient to yield a most instructive and representative forest economic collection, which has been arranged by products; *e.g.*, oil seeds; bast-yielding fibres; gums, resins, oleo-resins; animal products; drugs and spices; tans and dyes; distillation products, etc., etc.

In addition, the Research Institute possesses the most complete and authentic collection of Indian woods in existence; it has recently been re-arranged according to Natural Orders, and in this form it will be found to be of the greatest value both from a botanical and an economic point of view.

Sylviculture.—A representative Forest Museum, by which is meant a museum of sylvicultural and kindred exhibits does not exist at present, though this is undoubtedly a necessity if the Research Institute and College is to be properly equipped in future. The same remarks apply to a large extent to the collection of forest engineering models, which was at the close of the year in a sadly deficient and neglected condition.

This subject cannot be passed over without drawing attention to the totally inadequate space available for the accommodation of the various collections belonging to the Research Institute and College.

It has only been possible to house the existing collections by hiring a bungalow in one portion of the station; by placing the herbarium in another part of the station; and the remaining collections in different parts of the old College building; these various museums being thus very scattered at a considerable distance the one from the other. This naturally causes great inconvenience while the collections are even now very crowded and there is little room for expansion.

Another question calling for special comment is the absence of any qualified or trained assistants to look after the collections and see that they are kept in good order. As a consequence either this latter duty is left, with disastrous results, in the hands of untrained subordinates and peons; or the Research Officer is obliged to spend at the collections many hours which could have been devoted to far more valuable research work. These questions are, however now receiving attention.

Sub-section (b)—Ledgers.

The object of the so-called "Ledger Files" in which all information available on any particular subject is brought together and placed on record in an easily accessible form is two-fold:—

(1) To assist the progress of research work by enabling a Research Officer to quickly acquaint himself with all that is known about a subject which he has to investigate and by thus indicating to him the lines on which his research may be conducted with the greatest advantage.

(2) To make it possible to quickly place at the disposal of any one wishing for it all the information regarding any particular subject in which he may be interested.

It must, however, be recognized that as a general rule the most important duties of a Research Officer consist not in the collection and collation of information which already exists, but rather in the investigation of unsolved problems and in the discovery of new facts. While giving due weight, therefore, to the first class of work it is obvious that this must not be allowed to seriously retard the progress of the second.

Accepting this principle, therefore, and in view of the small establishment at present available it is clear that only such information should be collected as is of utility for the research work which has been undertaken or which is likely to be of use in the immediate future. The information which is at present of the greatest general utility is that which refers to forest products of economic value, while the Forest Economist, also, is to a certain extent less occupied with original research work than are other Research Officers.

Hitherto, therefore, the systematic maintenance of Ledger Files has been confined to the Forest Economic branch of the Research Institute where an endeavour has been made to maintain (so far as is possible with the establishment available) a complete set of Files on the same general lines as have been adopted in the office of the Reporter on Economic Products to the Government of India.

There has, however, been considerable uncertainty as to the procedure which ought to be followed with regard to this question in the other branches of the Research Institute.

Two proposals have been put forward :—

(*a*) That a Central Ledgering Bureau should be created.

(*b*) That the system in force in the Forest Economic branch should be extended to the other branches.

Neither of these is entirely satisfactory.

A large central bureau with branches dealing respectively with Forest Economy, Zoology, Botany, Chemistry and Forestry would in the first place require a very large establishment. Secondly, if the work of such a bureau is to be efficient it must be supervised by one or more highly paid expert officers who would be competent to discriminate between information which is likely to be of value and that which is comparatively worthless.

If in addition to the heavy cost of such an establishment we consider the further fact that a great deal of the information collected will be of no immediate utility, there certainly seems no justification for its creation, at all events until research work proper has been placed on a far more satisfactory basis than it is at present and for which considerable expenditure is necessary.

On the other hand with the establishment at present available if every Research Officer is required to maintain Ledger Files dealing with all subjects on which references may possibly be made to his office, the greater part of his time would be occupied in collecting information which is not directly connected with his research work, and which is of no immediate value and of doubtful future utility.

The progress of research work would thus be greatly retarded while the time spent on ledgering would be out of all proportion to its utility.

The most satisfactory procedure, therefore, undoubtedly appears to consist in :—

(1) Requiring the Forest Economist alone to maintain a complete set of ledger files dealing with all Forest Economic Products.

(2) Encouraging all other Research Officers to as far as possible place permanently on record in any form or method which may be most convenient to them all useful information, collected by them in the course of their investigations.

It is proposed, therefore, to enforce this procedure without delay.

Sub-section (*c*).—*Library.*

Before the Imperial Forest School was raised to the status of a Forest Research Institute and College, a fairly well-equipped scholastic library had been brought together dealing to some extent with all branches of science. In recent years this library has been somewhat neglected.

Owing to there being no whole-time librarian, books were frequently abstracted and wrongly dealt with, especially as the classification was complicated and unsatisfactory ; while each Research Officer in consequence of the deficiencies of the General Library was obliged to maintain a more or less complete library of his own.

Towards the close of the year this important question received considerable attention, the decision arrived at being that there should be only one central library for the whole Research Institute and College, and that this should be properly equipped and maintained, suitable facilities being given to all Research Officers to keep with themselves the books they constantly require for reference. A suitable system of classification was devised, and the work of rearranging the books is in progress.

Such a reference library is not only indispensible to the officers of the Research Institute but it will be found useful to all those interested in forestry and allied subjects.

A Catalogue is under preparation and will shortly be available to all Forest Officers wishing to make use of the Library.

The most important additions made to the Library during the course of the year related to botanical works. When the Saharanpur Herbarium was taken over it was found that the valuable library which was formerly attached to it had been removed to Cawnpore and placed in charge of the Economic Botanist to the Government of the United Provinces. This naturally discounted the value of the Herbarium considerably. As a result of action taken on representations made by the Forest Botanist, however, it was finally agreed that some 400 of the volumes of special value for the Herbarium should be returned to it. These books are expected early next year and will greatly increase the value of the existing Botanical Library. In addition several valuable volumes were purchased and added to the library of the Research Institute and College during the year.

Section 4.—Publications.

The following is a list of forest publications prepared during the course of the year by officers of the Imperial Forest Research Institute and others :—

Branch of Research	Name of publication.	Author.	Remarks.
Sylviculture	Glossary of Forest Technica Terms	A. M. F. Caccia, I.F.S.	Issued in July 1908.
	Note on the Selection method of treatment in India	Ditto	Issued in June 1909.
	The collection of statistical data relating to the principal Indian species	Ditto	Issued in July 1909.
	Notes on Sal in Bengal	A. L. McIntire, I.F.S.	Issued in March 1909.
	Forest Reservation in Burma in the interests of an endangered water-supply	A. Rodger, I.F.S.	Issued in July 1909.
	Fourth Revised Edition of D'Arcy's Working-Plans	A. M. F. Caccia, I.F.S.	In press at close of year.
	Note dealing with the progress made in Working-Plans	Ditto	Ditto.
Botany	A Manual of Forest Botany	R. S. Hole, I.F.S.	Issued in June 1909.
	Note on Teak Coppice	Ditto	In press at close of year.
Forest Economy	A Note on the Present Position and Future Prospects of the Catch Trade in Burma. (Indian Forest Record, Volume I, Part 3)	R. S. Troup, I.F.S.	Issued in January 1909.
	A Note on the Andamans Marble-wood ; (Diospyros Kurzii). (Forest Pamphlet No. 7, Forest Economy Series, No. 2)	Ditto	Issued in June 1909.
	Indian Woods and their Uses. (Indian Forest Memoir, Volume I, No. 1, Economic Products Series)	Ditto	Ditto.
	A Memoir on the Match Industry in India	Ditto	In press at close of year.
	A Note on Burmese Leza-Wood (Lagerstroemia tomentosa)	Ditto	Ditto.
	A Note on Carallia-Wood (Carallia integerrima)	Ditto	Ditto.
	A Note on Burmese *In*-wooi (*Dipterocarpus tuberculatus*)	Ditto	Ditto.
	A Note on Petwun or Trincomali-wood (*Berrya Ammonilla*)	Ditto	Ditto.
	A Note on Burma-Padauk (*Pterocarpus macrocarpus*)	Ditto	Ditto.
	A Note on the Fissibility of some Indian woods	Ditto	Ditto.

Branch of Research.	Name of publication.	Author.	Remarks.
Forest Zoology .	A Manual of Indian Forest Zoology for India	E. P. Stebbing, I.F.S. .	Issued in July 1909.
	Note on Chilgoza borers of Zhob. (Record Volume I, Part 3) . .	Ditto .	Issued in November 1908.
	Index of the 30 Volumes of Indian Forester	Ditto .	Ditto.
	Sal Bark Borer (Leaflet No. 1, Zoology Series)	Ditto .	Ditto.
	Teak defoliator (Leaflet No. 2, Zoology Series)	Ditto .	Ditto.
	Teak Leaf Skeletonizer (Leaflet No. 3, Zoology Series)	Ditto .	Ditto.
	Monograph on some Undescribed Scolytidæ (Memoir Volume I, Part I)	Ditto .	Issued in December 1908.
	Note on some Insect Pests of the Himalayan Oaks. (Record) . . .	Ditto .	In press.
	Second Monograph on some Undescribed Scolytidæ of Economic Importance from the Indian Region. (Memoir) .	Ditto .	Ditto.
	Note on the Insect Pests of the Chir Pine (Pinus longifolia) (Record) .	Ditto .	Ditto.
	Scolytus major. (Leaflet) . .	Ditto .	Ditto.
	Polygraphus major (Leaflet) . .	Ditto .	Ditto.
	Tomicus Ribbentropi. (Leaflet) . .	Ditto .	Ditto.
Forest Chemistry	A Note on Cutch Analysis and the preparation of pure Catechin . . .	Puran Singh, F.C.S. .	Issued in September 1908.
	Note on the Utilization of Khair forests in Eastern Bengal and Assam	Ditto .	ssued in July 1908.
	A paper on the future of Cutch and Katha manufacture . . .	Ditto .	Published in Indian Forester, January 1909.
	Note on the manufacture of Ngai. Camphor from Blumea balsamitera, DC., of Burma	Puran [Singh, F.C.S. .	Issued in November 1908.
	A Note on the manufacture of Shellac (the Note also deals with the utilization of coagulated lac) . . .	Ditto .	Issued in January 1909.
	A Chemical Investigation of the constituents of Burmese Varnish (Melanorrhœa usitata sap)	Ditto .	Issued in June 1909.
	A note on the distillation of Turpentine oil in India	Ditto .	In Press.
	A Note on the decolourization of the Mangrove Tannin	Ditto .	Ditto.
	A Note on the decolourization of sal bark extract	Ditto .	Ditto.
	A short Note on the bleaching of some Indian Match woods . . .	Ditto .	Ditto.

In Appendix I will be found a complete list of all forest publications issued since the formation of the Imperial Forest Research Institute in July 1906.

Section 5.—Miscellaneous.

Sub-section (a) —Experimental gardens.

The necessity of having available in the immediate neighbourhood of the Research Institute, a sylvicultural and botanical garden for the experimental cultivation of the plants under

study has been fully recognised. Two distinct areas were accordingly selected for the purpose towards the close of the year and steps taken to have them demarcated and put in order.

Sub-section (b)—Indents.—

The duties of the officers of the Research Institute in the matter of dealing with indents for forest products are clearly set forth in the following circular, Inspector-General of Forest's Circular No. 16-289-8, dated the 18th August 1908) :—

In order not only to utilize the staff and collections at the Forest Research Institute, Dehra Dun, so as to efficiently meet enquiries and requisitions regarding forest products, but also to prevent the duplication of work both in collection and investigation, it appears to be desirable to arrange that a more careful scrutiny may be possible into the demands made on Forest officers for specimens of forest products so that the time and labour spent on this work may in future be reduced.

Indents received by Forest officers may be classified broadly under two heads—

I. Those emanating from foreign countries, often for considerable quantities of seed, for samples of commercial products, for museum specimens, etc.

II. Those received from England or India from official or private individuals for samples of forest products, botanical or wood specimens, etc.

Indents under the first heading are in many cases addressed to the Government of India or to Local Governments and are transmitted to suitable Forest Circles whence the material is supplied direct to the country concerned. Such indents do not occupy much time or cause much trouble, they comprise as a rule well known articles whose collection and despatch is a purely business matter. It is otherwise with indents coming under the second head. These are sometimes addressed direct to the Inspector General of Forests and at others to local forest officers often to two or more officers simultaneously and, perhaps unavoidably, with insufficient regard to the locality of origin of the product or specimen asked for, or to the trouble and expense entailed in searching for an object which may be rare in the locality selected.

To remedy these disabilities it is proposed to constitute at Dehra Dun a Bureau of information and of distribution for indents on the Forest Department, open to the use of all those who may wish to save time and trouble in this regard. The procedure which it is proposed to adopt is as follows :—

(i) Enquiries on all questions relating to forest products may be addressed to the President, Forest Research Institute, Dehra Dun, who will either personally or through one of the officers attached to the Institute reply thereto at once; or he will, after investigation made by the latter, publish the results thereof if considered of sufficient importance.

(ii) The President, Research Institute, will receive indents for forest products or specimens and distribute them in such manner that there shall be no duplication of material or of research. Forest officers are invited to transmit to him any indents they may receive of a general nature so that if necessary the various items may be assigned as far as possible to those who are in a position most readily to collect them. As a rule subsequent correspondence will be carried on direct by the supplying officer, but if so desired the President, Research Institute, will through the agency of the research officers, undertake such correspondence if thereby any relief is afforded to local forest officers. In any case the articles collected should be transmitted direct to the parties indenting, and the President, Research Institute, would be glad to receive notice of the completion of an indent so that the case may be struck off his books. In this regard it has been already arranged that indents from the Reporter on Economic Products should in future be sent not to Forest officers direct but to the President, Research Institute, so that these officers may be in a position to keep each other informed when a new subject of investigation is taken up and be in a position to decide by whom the investigation is to be conducted.

In Appendix II will be found a full account of seeds, timbers and other forest produce supplied during the year under report to British Colonies, Foreign Governments, Institutions etc. The most important of these indents related to the supply of a large quantity of seed to the Forest Department of South Nigeria.

In addition some boxes of entomological specimens were sent to the Director of the Balaghat Forest School, Central Provinces, to aid in laying the foundation of a collection of Central Provinces Injurious Insect Pests for the School Museum. These included :—

I. *Hoplocerambyx spinicornis.*
   1. Male and female beetles.
   2. Eggs.
   3. Larva.
   4. Pupa.
   5. Section of Sal tree showing attacks of larva in the bast and wood.

II. *Geelosperna scabrata.*
   1. Male and female beetles.
   2. Branches of Acacia arabica showing bark stripped off by the beetles.

III. *Cœlosterna scabrata.*
   1. Beetle.
   2. Two portions of roots of Acacia Arabica showing the tunnels made by the grubs in the heart of root. These tunnels kill the tree.

IV. *Psiloptera fastuosa.*
   1. Two beetles.
   2. Branches of Acacia showing bark stripped off by the beetles.

V. *Sinoxylon crassum. (Bostrichidæ).*
   1. Beetles.

VI. *Dinoderus pilifrons.*
   1. Beetles.

VII. *Hyblœa puera.* (*Noctuidæ*).
1. Moths.
2. Caterpillar defoliates leaves of Teak eating all parenchyma and leaving only main and side ribs.

VIII. *Pyrausta machœralis.* (*Pyralidæ.*)
1. Moths.
2. Caterpillar skeletonizes Teak leaves.

Sub-section (c)-Tours.

Tours of Research Officers in connection with research work during 1908-09 were generally greatly interfered with and in many cases rendered impossible, owing to officers being required to accompany students on tour in order to supervise their studies and attend to disciplinary matters.

The Imperial Forest Zoologist was, however, able to undertake a lengthy tour through the Mandla forests of the Central Provinces and through the Chamba State, Punjab, for the special purpose of studying the Sal and coniferous insect pests respectively. The results obtained during these tours have been briefly referred to in a previous section of this report.

In December and January, the Imperial Sylviculturist paid visits to Berar and to the Madras Presidency, chiefly with the object of obtaining information regarding plantations of Babul, Eucalyptus, Teak, and Casuarina. He also attended and read a paper before the Central Provinces Forest Conference in Nagpur.

The value of the research work done on any particular problem is as a rule directly proportional to the time which the Research Officer can spend in investigating it personally on the spot in the forest. It is, therefore, greatly to be regretted that owing to other duties the time which Research Officers, and especially the Sylviculturist and Botanist, have been able to devote to research work in the forests has been so greatly restricted.

The tours actually undertaken by the officers of the Research Institute during the year under report are given in detail in Appendix III. The President wishes to express his thanks to those Officers of the Department, Conservators and Divisional Forest Officers, who so kindly assisted Research Officers on tour.

CHAPTER III.

FINANCIAL.

The expenditure of the year under report is compared with the corresponding figures of the previous year in the following statement:—

Budget Head.	Expenditure during the year.		Difference + or.—
	1907-03.	1908-09.	
	R	R	R
A VI. Stores, Tools and Plant, etc.	2,974	8,542	+5,568
A VII. Buildings, etc.	350	2	—348
A IX. Miscellaneous Charges	4,295	4,218	—77
B I a. Superior Officers	48,124	50,442	+2,318
B I d. Office Establishment	10,541	12,176	+1,635
B. I e. Deputation and Special Allowances	8,285	9,286	+1,001
B I f. Exchange Compensation Allowance	...	2	+2
B II. Travelling Allowances	10,043	7,098	—2,945
B III. Contingencies	6,181	9,544	+3,363
Grand Total of all Expenditure	90,793	101,310	+10,517

The above does not include the salary of the President, which is charged to the Forest College budget.

The large increase under head A VI c is due to expenditure incurred in the equipment of the Chemical Laboratories of the Research Institute, an inevitable initial expenditure; and in

the preparation of insect cases for the zoological section. In the former branch a sum of Rl,480 was expended in purchasing a camphor still for experimental research purposes, and physical apparatus at a cost of Rl,533.

The only other budget head, which calls for comment is the increased expenditure under B III, due to the purchase of Botanical and Chemical works required for reference and to bring the Research Institute and College Library more up to date.

The financial statements of the year will be found at the end of this Report (Appendices V, VI, and VII).

CHAPTER IV.

GENERAL.

The conduct of research work.—It has been evident since the inauguration of the Research Institute in 1906 that all research work has been much hampered owing to the scope of the work in the various branches not having been sufficiently clearly defined, and owing to a decision not having been arrived at as to the conditions essential for the satisfactory accomplishment of such work. This subject received considerable attention during the course of the year; a set of proposed rules for the conduct of research work in the various branches of the Research Institute were drawn up and these are now being circulated for opinion and criticism, with the object of arriving at some definite conclusion on the subject.

The principle which it is wished to introduce is that all field and laboratory experimental work shall in future be carried out wholly by the officers of the Research Institute. The experience gained during the past three years has clearly demonstrated that though Conservators and Divisional officers are able to assist the Institute with much valuable information, material for investigation, and data; press of other duties absolutely prevents their undertaking the carrying out of elaborate field experiments, requiring constant attention and frequent recording of results; and in no branch of the Institute has this fact made itself more apparent than in dealing with sylviculture.

The practicability of enforcing these principles has already been fully proved in the case of the Zoology, Botany, Forest Economy and Chemistry branches of the Institute, and no difficulties are anticipated. In the case of the Zoology branch, Forest officers are asked to report immediately all serious insect attacks and insect damage that may come to their notice, and in special cases selected officers may be asked to collect particular stages in the life history of an insect or to afford information as to the abundance of a well-known pest at definite seasons in the year. Similarly in the case of the Economic and Chemistry branches, Forest officers may be asked from time to time to supply a small quantity of forest produce (wood, bark, seed, etc.), as required for experimental purposes. But, as already remarked, the actual research work, the laboratory and field experiments can be carried out most satisfactorily by the officers of the Research Institute, especially in the event of their being supplied with suitable establishments. In the case of the Sylvicultural branch the principle above enunciated can to commence with only be introduced experimentally on a small scale, for it is evident that this implies the laying out of numerous "*Experimental stations*" throughout the Forest areas under investigation, in each of which numerous measurements and observations must be recorded at frequent intervals; and this can only be done with an adequate trained establishment. The clear definition of the extent of each Research officer's responsibility in regard to any particular problem under study has also the great advantage of preventing duplication of work and of insuring co-operation among Research officers to attain a common object.

Programme of research.—The programme of Research work, sanctioned for the year under report, will be found in Appendix IV. A more complete and detailed revised programme of Research work, designed to meet the requirements of the proposed method of procedure referred to in the preceding paragraph, which defines clearly the subjects to be investigated and the responsibility of each Research officer in respect to it, was drawn up at the close of the year, but this still awaits sanction.

Establishments.—The reorganization of the clerical and menial establishment of the Research Institute was sanctioned in Government of India's letter No. 154 F.—341-2, dated the 20th January 1909; and it was brought into force on the 1st February 1909. The immediate result of this reorganization has been the formation of the President's office, which did not previously exist. This office was placed in charge of Babu Nipendra Nath De, who had hitherto been special Head Assistant in the Working-Plans office. He has done yeoman service in getting this office started on correct lines. With the exception of the President's office, the clerical establishment sanctioned is sufficient for the present requirements; but no provision appears to have been made to meet the special requirements of different branches of the Research Institute. Qualified Assistants are urgently required both in the Zoological and Botanical sides of the Institute to look after the valuable collections, upon which a considerable amount of money and labour has been spent and to see that they are kept in order. Such trained assistants would also help in carrying on experiments during the absence of the Research Officer on tour. In the Chemical branch the necessity for a competent scientific assistant to look after the laboratory fittings, apparatus and chemicals, and at times to assist the Chemist in ordinary routine analytical work must

be insisted upon. Taking into consideration the manner in which the work in this branch has expanded during the past year, it is evident that the Chemist has no time to look after every detail of the laboratory and to carry out unaided all the work required of him. Lastly it has become apparent from the experience gained during the past few years that a subordinate staff to assist the Imperial Sylviculturist and Superintendent of Forest Working-Plans is a necessity if any real progress is to be made in research work in Sylviculture and Working Plans.

Proposals to remedy the above deficiencies were submitted for the orders of the Government of India after the close of the year.

Great improvement was effected during the year in the management of the Research offices, owing to the introduction of a more systematic and correct method of maintaining records and registers. The initiation of this work was placed in charge of Babu Nipendra Nath De, the Head Assistant of the President's office, who did excellent work. The Head Clerks of the Zoologist's, the Botanist's and the Economist's offices also deserve credit for the manner in which they have carried out this work.

Buildings.—Throughout the body of this report, reference has had to be made to the crying need for additional and more suitable accommodation. A great deal was done towards the close of the year to make the best possible use of the available space by a redistribution of the various offices: and it is only owing to two large buildings, both situated at some distance from the main Research Institute and College buildings, having been made use of that it has been found possible to temporarily house the various offices and collections. The inconvenience, however, of having the different branches of the Research Institute scattered in various parts of the station is only too obvious to need comment. The following extracts from the annual progress reports of the various Research Institute branches very clearly explain the present state of affairs:—

The Imperial Forest Botanist writes: "Inconvenience must necessarily be experienced until the new Research buildings are available with adequate provision for a laboratory and facilities for microscopic work. Work, however, has hitherto been greatly retarded owing to the fact that the Botanist's bungalow was situated 1½ miles from his office and the herbarium and about 2 miles from the experimental garden which caused great waste of time and inconvenience. Towards the close of the year the Botanist was allowed to occupy a bungalow on the Chandbagh Estate where he is in the immediate vicinity of the herbarium, his office and the experimental garden and this will greatly facilitate future work."

Mr. Stebbing, the Imperial Forest Zoologist, makes the following remarks: "The setting up of the Forest Zoology collection has drawn marked attention to the totally inadequate space available for the accommodation of this branch of the Research Institute. For present requirements I need at least three times the space allotted to me. In the interests of the future I have re-examined the plan of the rooms to be allotted to the Forest Zoologist in the new Institute building and I find that these are absurdly inadequate for the present requirements and that there is no provision whatsoever for future expansion. In addition no space has been allotted for an Insectary or outside workshop both of which will be needed. An examination of the site upon which the new Institute building is to be erected has failed to show that land will be available for such requisites."

The Imperial Sylviculturists (Mr. R. S. Troup) says: "If sylvicultural collections are to be developed as they should be, the existing museum accommodation is totally inadequate. For this reason the Imperial Sylviculturist can make no attempt to form such collections, as there is no accommodation for them. The office accommodation also is too cramped, there being little or no room for the necessary expansion when records of sample plots throughout India come to be maintained by the Superintendent of the Forest Working-Plans. The space necessary for the storage of photographic collections—a very necessary part of the Sylviculturist's work—is quite inadequate."

Whilst the following is extracted from the Imperial Forest Economist's report: "The existing economic specimens will practically fill all the available space now allotted for this purpose, leaving but little room for expansion. If the proposals now made to complete these collections are carried out, the available space will be by no means sufficient. As regards the wood supecimen collections now to be housed in the old chemical laboratory, the space allotted is sufficient for storing them, but by no means sufficient to exhibit them to advantage."

Appreciation of services.—In addition to the officers mentioned in the body of this report, the thanks of the Research Institute are specially due to Mr. J. H. Lace, I.F.S., F.L.S., Chief Conservator of Forests, Burma, for much valuable assistance given to all branches of the Institute both in the form of information and material.

In conclusion, the President wishes to acknowledge the services rendered by the officers of the Research Institute, and more particularly for the work done in organizing and initiating work in their various branches. The officers have generally worked under great difficulties, but there is no doubt that great progress has been made in getting the Institute firmly established on sound foundations.

A. M. F. CACCIA,

Officiating Conservator of Forests and President,
Imperial Forest Research Institute

DEHRA DUN;
1st September 1909.

APPENDIX I.

List of all forest publications issued since the formation of the Imperial Forest Research Institute.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price.	Remarks.
					R a. p.	
1	Zoology Series	Note upon the Bee-Hole Borer of Teak in Burma.	E. P. Stebbing, F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Bulletin No. 1	...	Issued in 1905.
2	„	Note on the Quetta Borer	Ditto . .	„ „ 2	...	Ditto.
3	„	Note on the Chilgoza (Pinus Gerardiana) Bark-boring beetles of Zhob, Baluchistan.	Ditto . .	„ „ 3	...	Ditto.
4	„	Notes on a visit to some European Schools of Forestry.	Ditto . .	„ „ 5	...	Ditto.
5	„	Note on the life history of Hoplocer ambyx spinicornis.	Ditto . .	„ „ 8	...	Issued in 1906.
6	„	Note on the Duki Fig tree borer of Baluchistan.	Ditto . .	„ „ 10	0 7 0	Ditto.
7	„	Note on some Assam Sál Insect Pests.	Ditto . .	„ „ 11	1 10 0	Issued in 1908.
8	„	Monograph on Lac . .	Ditto . .	Record, Volume I, Part I.	1 4 0	Ditto.
9	„	Note on Chilgoza borers of Zhob.	Ditto . .	Record, Volume I, Part III.	...	Ditto.
10	„	Monograph on some Undescribed Scolytidæ.	Ditto . .	Memoir, Volume I, Part I.	1 4 0	Ditto.
11	„	Note on the Attack of Bark boring beetles in the Coniferous Forests on the Simla Catchment Area.	Ditto . .	Pamphlet No. 2, Series No. 1.	...	Ditto.
12	„	Sal Bark Borer . .	Ditto . .	Leaflet No. 1 .	...	Ditto.
13	„	Teak Defoliator . .	Ditto . .	„ „ 2 .	...	Ditto.
14	„	Teak Leaf Skeletonizer .	Ditto . .	„ „ 3 .	...	Ditto.
15	„	Manual of Forest Zoology	Ditto . .	Manual . .	10 0 0	Ditto.
16	Working-Plans	Preliminary note on the development of the Sâl.	A. M. F. Caccia, I.F.S., M V.O., F.Z.S., Imperial Superintendent of Forest Working-Plans.	Record, Volume I, Part II.	1 4 0	Ditto.
17	„	Glossary of Forest Technical Terms.	Ditto . .	Pamphlet No. 3, Series No. 1.	0 4 0	Ditto.
18	„	Note on the Selection System in Indian Forests as exemplified in Working-Plans based on this system, with a short description of some continental methods.	Ditto . .	Record, Volume I, Part IV.	1 4 0	Issued in 1909.
19	Sylvicultural Series.	Note on the Chilgoza forests of Zhob and the Takht-i-Suliman.	E. P. Stebbing, F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Bulletin No. 7	...	Issued in 1906.
20	„	Note on the influence of forests on the storage and regulation of the water supply.	S. Eardley-Wilmot, Esq., Indian Forest Service.	„ „ 9	...	Ditto.
21	„	Notes on Sâl in Bengal .	A. L. McIntire, I.F.S., Conservator of Forests, Bengal.	Pamphlet No. 5, Series No. 1.	0 4 0	Issued in 1909.
22	„	Monograph relating to Forest Reservation in Burma.	Alexander Rodger, I.F.S., Conservator of Forests, Burma.	...	1 0 0	Ditto.

APPENDIX I—*continued.*

List of all forest publications issued since the formation of the Imperial Forest Research Institute.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price.	Remarks.
					R a. p.	
23	Economy Series	Ficus Elastica: Its Natural growth and artificial propagation.	E. M. Coventry, Esq., Deputy Conservator of Forests.	Bulletin No. 4	...	Issued in 1906.
24	„	Memorandum on Mechanical Tests of some Indian Timbers.	W. H. Everett, B.A., B.E., M.I.Mech. E., M.I.E.E., Professor, Sibpur Engineering College.	Bulletin No. 6	...	Issued in 1906
25	„	Andamans Padauk . .	B. B. Osmaston, I.F.S., Conservator of Forests, United Provinces, Western Circle.	Record, Volume I, Part III.	...	Issued in 1908.
26	„	Note on the Present Position and Future prospects of the Cutch Trade in Burma.	R. S. Troup, F.C.H., Imperial Forest Economist.	Record, Volume I, Part III.	...	Ditto.
27	„	Note on Indian Woods and their uses.	Ditto . .	Memoir, Volume I, Part I.	2 12 0	Ditto.
28	„	Note on Lac and Lac Cultivation.	D. N. Avasia, Instructor, Imperial Forest College, Dehra Dun.	Pamphlet No. 4, Series No. 1.	0 2 0	Issued in 1909.
29	„	Note on Andamans Marble Wood or Zebra Wood.	R. S. Troup, F.C.H., Imperial Forest Economist.	Pamphlet No. 7, Series No. 2.	0 4 0	Ditto.
30	Botanical Series	Manual of Botany . .	R. S. Hole, F.C.H., F.L.S., F.E.S., Imperial Forest Botanist.	Manual . .	...	Ditto.
31	Chemistry Series.	Note on the Manufacture of Ngai Camphor.	Mr. Puran Singh, F.C.S., Acting Imperial Forest Chemist.	Record, Volume I, Part III.	...	Issued in 1908.
32	„	Note on Cutch Analysis and preparation of Pure Catechin.	Ditto . .	Memoir, Volume I, art I.	1 4 0	Ditto.
33	„	Note on Utilisation of Khair Forests.	Ditto . .	Pamphlet No. I, Series No. I.	0 4 0	Ditto.
34	„	Monograph on the Chemical Constituents of Burmese Varnish.	Ditto . .	Record, Volume I, Part IV.	...	Issued in 1909.
35	„	Manufacture of Pure Shellac.	itto . .	Memoir, Volume I, Part II.	0 8 0	Ditto.
36	Zoology Series	Note on some Insect Pests of the Himalayan Oaks.	Ditto . .	Record, Volume II, Part I.	...	In Press.
37	„	Second monograph on some Undescribed Scolytidæ of Economic Importance from the Indian Region.	Ditto . .	Memoir, Volume I, Part II.	...	Ditto.
38	„	Note on the Insects Pests of the Chir Pine (Pinus longifolia).	Ditto . .	Memoir . .	...	Ditto.
39	„	Scolytus major . .	Ditto . .	Leaflet No. 4 .	...	Ditto.
40	„	Polygraphus major .	Ditto . .	„ „ 5 .	...	Ditto.
41	„	Tomicus Ribbentropi .	Ditto . .	„ „ 6 .	...	Ditto.
42	Working-Plans	Note dealing with the progress made in Working-Plans and their classifications according to Sylvicultural System in force.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Imperial Superintendent, Forest Working-Plans.	Pamphlet No. 9, Series No. 3.	...	Ditto.
43	„	Manuscript of a fourth revised edition of D'Arcys Working-Plans.	Ditto . .	...	...	Ditto.

APPENDIX I—*concluded.*

List of all forest publications issued since the formation of the Imperial Forest Research Institute.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price. R. a. p.	Remarks.
44	Economy Series	Note on Fissibility of some Indian Woods.	R. S. Troup, F.C.H., Imperial Forest Economist.	Record, Volume II, Part II.	...	In Press.
45	,,	Note on the Prospects of Match Industry in India.	Ditto . .	Memoir, Volume I, Part II.	...	Ditto.
46	,,	Note on Leza Wood (Lagerstræmia tomentosa).	Ditto . .	Pamphlet No. 10, Series. No. 3.	...	Ditto.
47	,,	Note on Carallia integerrima Wood.	Ditto . .	Pamphlet No. 11, Series No. 4.	...	Ditto.
48	,,	Note on Burmese In Wood (Dipterocarpus tuberculatus.	Ditto . .	Pamphlet .	...	Ditto.
49	,,	Note on Burma Padauk (Pterocarpus macrocarpus).	Ditto . .	,, .	...	Ditto.
50	,,	Note on Petwun or Trincomali Wood (Berrya Ammonilla).	Ditto . .	,, .	...	Ditto.
51	Botanical Series	Note on Best Season for Coppice Fellings of Teak (Tectona grandis).	R. S. Hole, F.C.H., F.L.S., F.E.S., Imperial Forest Botanist.	,, .	...	Ditto.
2	...	Forest Flora of Chota Nagpur.	H. H. Haines, F.C.H., Conservator of Forests.	...	...	Ditto.
53	Sylvicultural Series.	Translation of Jacquot's "Incendies n Forests".	C. E. C. Fischer, Deputy Conservator of Forests.	Manual . .	...	tto.

APPENDIX II.

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1908-09.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
23rd September 1908.	Director, Royal Botanic Gardens, Peradeniya, Ceylon.	Deputy Conservator of Forests, Darjeeling Division, Bengal.	Preng bamboo .	Seeds .	2 lbs.	
23rd October 1908.	Federico-Albert, Chief Section de Aguas, Santiago, Chib.	Deputy Conservator of Forests, Jaunsar Division, United Provinces.	*Cupressus torulosa.*	Botanical specimens.	...	
12th November 1908.	M. de Plason de Waestyne, Conseiller du ministre des affairs, Etraugeres, Vienna, Austria.	Conservator of Forests, Punjab.	*Pinus longifolia*	Seeds .	20 lbs.	
4th December 1908.	Ditto Ditto .	Ditto .	*Abies Pindrow*	Do. .	25 „	
Ditto	Ditto Ditto .	Ditto .	*Sinus Gerardiana.*	Do. .	20 „	
Ditto	Chief Branch of Sylviculture, Forest Service Department of Agriculture, Washington, (U. S. A.).	Ditto .	*Cedrus Deodara*	Do. .	60 „	
16th January 1909.	M. de Plason de la Waestyne, Conseiller du ministre des affairs, Etraugeres, Vienna, Austria.	Ditto .	*Pinus excelsa* .	Do. .	40 „	
15th February 1909.	Federico-Albert, Chief Section de Aguas, Santiago, Chib.	Deputy Conservator of Forests, Jaunsar Division, United Provinces.	Ditto .	Do. .	10 „	
5th March 1909.	The Botanist, Department of the Interior, Bureau of Science, Manila.	Imperial Forest Economist, Dehra Dun.	33 different species.	Wood specimens.	33	
6th May 1909	Superintendent, Royal Botanic Garden, Sibpur.	Conservator of Forests, Bengal.	*Holoptelia integrifolia.*	Seed .	10 lbs.	
4th June 1909	Ditto Ditto .	Ditto .	*Marsdenia tenacissima.*	Do. .	40 oz.	
8th „ „	Chief Conservator of Forests, British East Africa.	Conservator of Forests (Southern Circle), Madras.	Teak seed .	Do. .	40 lbs.	
14th „ „	Ditto Ditto .	Conservator of Forests, (Western Circle), United Provinces.	Toon seed .	Do. .	30 „	
4th „ „	Ditto Ditto .	Conservator of Forests, Punjab.	*Cedrus Deodara* .	Do. .	10 „	
12th „ „	Ditto Ditto .	Conservator of Forests, Eastern Bengal and Assam.	*Pinus Khasya* .	Do. .	20 „	
22nd July 1909.	Reporter on Economic Products to Government of India.	Conservator of Forests (Eastern Circle), United Provinces.	*Bassia butyracea*	Do. .	16 „	
28th April 1909.	Ditto Ditto .	Ditto .	*Cordia Rothii* .	Timber .	One piece with Botanical specimens.	
2nd August 1909.	Professor Percy Groom, Royal College of Science, South Kensington, London.	Imperial Forest Economist.	(1) *Quercus incana* (2) *Quercus dilatata.* (3) *Quercus Semicarpifolia.*	Do. Do. Do.	One log of each	

APPENDIX II—*concluded.*

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1908-09.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
31st March 1909.	Reporter on Economic Products to Government of India.	Conservator of Forests, (Western Circle), United Provinces.	*Oronylum indicum.*	Bark .	10 lbs.	
8th June 1909	Superintendent, Royal Botanic Garden, Sibpur.	Imperial Forest Botanist, Dehra Dun.	*Cymbopoyon Jwarancusa Schult.*	Grass .	...	
22nd „ „	The Consul General for Portugal, Bombay.	Ditto .	*Bombax malabaricum.*	Seeds .	21 lbs.	Indents for other kinds of seeds have to be supplied.
Ditto	Ditto Ditto .	Ditto .	*Butea frondosa.*	Seed . .	8 „	
Ditto	Ditto Ditto .	Ditto .	*Populus euphratica.*	Do. .	12 „	Indent received on 21st April 1909.
7th June 1909	The Director of Forests and Gardens, Port Louis, Mauritius.	Ditto .	*Pinus longifolia*	Do. .	25 „	
27th October 1908.	Conservator of Forests, Lagos, Southern Nigeria.	Ditto .	Teek sseep from Burma.	Do. .	39½ „	
Ditto	Ditto Ditto .	Ditto .	Teek seed from India.	Do. .	37 „	
20th February 1909.	Ditto Ditto .	Ditto .	*Pterocarpus indicus.*	Do. .	42 „	
Ditto	Ditto Ditto .	Ditto .	*Dalbergia Sissoo.*	Do. .	26 „	
Ditto	Ditto Ditto .	Ditto .	*Cedrela Toona* .	Do. .	10 „	
17th June 1909	Ditto Ditto .	Ditto .	*Pinus Merkusii.*	Do. .	5 „	
22nd March 1909.	The Chief Conservator of Forests, Cape Town.	Ditto .	Cuttings of *Tamarix articulata.*	...	200	

APPENDIX III.

Tours connected with research work undertaken by Officers of Imperial Forest Research Institute during 1908-09.

Name of Research Officer.	Date of tour.	Name of locality or Province where investigation was carried out.	Remarks including object of visit.
Imperial Forest Zoologist.	1st to 13th August 1908.	Simla Catchment Area Forests.	During a 10 days visit to Simla on casual leave 4 days were spent visiting the Catchment Area forests to study the bark beetle attack.
	29th to 31st August 1908.	Lachiwala . . .	To study Sal and Terminalia tomentosa insect pests.
	3rd to 6th April 1909.	Kustore Colliery, Kusunda.	To report on a supposed attack of White Ants or Termite in a small Sal Forest.
	7th to 9th April 1909.	At Calcutta . . .	
	10th to 5th May 1909.	Mandla : Central Provinces	Study of Sal pests.
	11th to 15th May 1909.	Mussoorie . . .	Examined felled Oak trees in station.
	17th to 4th July 1909.	Chamba . . .	Study of Coniferous pests.
Imperial Forest Botanist.	24th and 25th July 1909.	Saharanpur . . .	To take charge of the Saharanpur Herbarium.
	26th December to 25th January 1909.	Siwalik Forest Division .	Studying *Grewia* and *Grasses*.
	7th to 13th February 1909.	Lahore	Attended Forest Conference.
	11th to 15th June 1909.	Jaunsar Division, Tons Valley.	Studying *Grewia*.
Imperial Sylviculturist and Superintendent, Working-Plans.	22nd to 30th November 1908.	Nagpur, Central Provinces	Attended Forest Conference.
	1st to 7th December 1909.	Berar, Amraoti . .	Study of Babul.
	7th to 22nd December 1908.	Ootacamund, Madras,	Eucalyptus.
	8th to 31st December 1908.	Nilambur, Madras .	Teak Plantation.
	1st to 7th January 1908.	Nellore, Madras . .	Casuarina plantations.
	15th to 25th June 1908.	Jaunsar Division United Provinces.	Study of Uniform Method in Chir forests.
Imperial Forest Economist.	.....	.....	In camp only in connection with the instructional work of the College.
Imperial Forest Chemist.	12th to 17th August 1908.	Visit to Kalsi Turpentine Factory.	Visits were paid to the distilleries with the object of suggesting such changes in the distillation process as might be necessary to improve the quality of the distilled oil. Some experimental work was done on the spot at the Bhowa. Distillery and much useful information was collected.
	13th to 16th November 1908.	Visit to Bhowali Turpentine Factory.	

APPENDIX III—*continued*

Tour connected with research work undertaken Officers of Imperial Forest Research Institute during 1908-09.

Name of Research Officer.	Date of tour.	Name of locality or Province where investigation was carried out.	Remarks including object of visit.
	9th to 31st December 1909.	Agra and Cawnpore .	To study tannins and tannin factories.
	13th January 1909 to 7th February 1909.	Rangoon . . .	Ditto, ditto.
	3rd to 29th May 1909.	Punjab . . .	To study Deodar soils.
	30th May 1909 to to 24th June 1909.	Raipur, Central Provinces	At the request of the Conservator of Forests, Southern Circle, Central Provinces, the Forest Chemist went to Raipur to demonstrate the working of his Shellac apparatus and the method of Manufacture of Shellac.

APPENDIX IV.

Programme of work of the Imperial Forest Research Institute.

The following are some of the various investigations which will be made by officers of the Imperial Forest Research Institute, Dehra Dun, with the assistance of other officers of the Department.

I.—Working-Plans.

1. The compilation from selected Working-Plans of data regarding the rate of growth of different species (ring countings, sample plots) and generally the tabulating, in convenient form, of statistics and information regarding different species, methods of working, etc., now scattered throughout the plans. A statement showing sanctioned Working-Plans, with area of forest, period of plan, method of treatment and principal species has already been compiled as a basis of this and other investigations.

2. With regard to normal stock, selected areas containing what appears to be a full stock of I, II, III and other classes will be counted out, and the average of each class taken as an approximate normal, as a preliminary to the more accurate investigation of this subject. The following species will be first taken in hand—Sal, Teak, Deodar, Pinus longifolia, Pinus excelsa, and other species now being worked under Working-Plans as soon as possible.

3. A careful study of the selection system will be made. The following points merit attention in this regard in order to discover the best means of working by compartments so as most nearly to approach the ideal method of working over the entire area annually for the removal of mature trees, *e.g.*—

(*i*) By making the annual coupes as large as possible so that the area may be worked over at as frequent intervals as possible.

(*ii*) By fixing such an exploitable girth that the loss of interest due to leaving mature trees standing for an excessive period is reduced.

(*iii*) By allotting gradually decreasing areas for the annual coupes.

4. The examination of control forms in order to ascertain the average outturn by different methods of working in force, and generally to collect and collate the statistics of the results of forest management throughout India which are included in past control forms will be continued.

5. Preparation for teak of a paper setting forth all that is known regarding habits, methods of treatment, etc, such as has already been prepared for the sâl.

6. Preparation of yield tables (as far as data are available) for:—

(*i*) Sissoo plantations at Changa-Manga.

(*ii*) Eucalyptus plantation at Ootacamund.

(*iii*) Casuarina plantations in Madras.

(*iv*) Teak plantations at Nilambur.

7. Preparation of tables of outturn for:—

(*i*) Some selected high forests in the United Provinces (or elsewhere) under the selection system, in which enumerations have been carried out.

(*ii*) Some selected sâl coppice forests in the United Provinces.

(*iii*) Teak forests in Burma.

8. Preparation of a note on the application of the *uniform method* with special reference to India and with examples from Indian working-plans.

9. Upkeep of Registers of sample plots and publication of any data available.

10. Opening of Ledger files relating to definite subjects under investigation or to be hereafter brought under investigation.

II.—Sylviculture.

11. A practical examination will be continued into the effects of fire on grazing areas in order to ascertain:—

(*i*) Whether the grass on areas burned over annually decreases in quantity and quality;

(*ii*) whether this result or the reverse happens in the case of areas protected from fire, and especially whether protection from fire encourages the growth of coarser grasses, or leads to the replacement of coarse grasses by others more suitable for fodder.

12. Study of the effects of fire conservancy on different species in various conditions of climate and growth, more especially on sâl and teak, will be continued.

13. An examination into the conditions favourable to the replacement of the selection method by the regular method will be continued.

14. Investigation into the effects of soil composition and underlying rock on the distribution and growth of different species will be continued.

15. Enquiry into the effects of the continuance of a given species (*e.g.*, sâl, teak) as regards the soil fertility for that species will be continued.

16. Collection of information regarding plantation work carried out on a large scale, specially Agri-sylvicultural operations and the planting of arid lands and shifting sands; and the publication of pamphlets dealing with these subjects.

17. Investigation into the effects of felling bamboos above or below the first node.

18. The study of teak reproduction in conjunction with the Imperial Forest Botanist and the Imperial Forest Chemist.

19. The study of sâl reproduction in conjunction with the Imperial Forest Botanist and Imperial Forest Chemist.

20. Putting in order the Kaunli garden for sylvicultural research purposes in conjunction with the Imperial Forest Botanist.

21. Subjects to be investigated on the initiation of Conservators by them in conjunction and in correspondence with the Sylvicultural branch of the Research Institute.

III.—Forest Zoology.

22. Investigation (in the United Provinces) into the distribution and life histories of the *Monophlebus* scale insect, *Spærotrypes siwalikensis*, and the sâl defoliators in the sub-montane sâl areas of the Ganges, Garhwal, Kumaun and Naini Tal divisions and into the Pinus longifolia *Cryptorrhynchid* weevil, *Tomicus* and *Polygraphus* bark-borers and *Platypus* wood-borer in the *chir* areas of Garhwal, Kumaun and Naini Tal divisions will be continued.

23. Investigation (in the Punjab) into the distribution and life histories of the following insects in the hill coniferous forests of the Kangra Division :—

The *Scolytus* pests of the deodar and the *Polygraphus Pityepenes*, *Platypodæ* and cone-borers and defoliators of the Pinus excelsa, Spruce and Silver fir; also the defoliating and wood-boring pests of the hill oaks and pests of Pinus longifolia will be continued.

24. Investigation into the autumn generations of the life histories of the insect pests of Deodar, Silver fir, Spruce, Blue Pine, and Pinus longifolia will be continued.

25. Investigation into the insect pests of the sâl tree in Oudh.

26. Investigation into the life history of the *Padauk* weevil pest and the *Padauk Scolytid* wood-borer.

27. Investigation into an important *Scolytid* wood-borer of the "sundri," a defoliating pest of this tree and other pests of the mangrove forests.

28. Boring molluses of bamboos in tidal waters in Burma.

29. Destruction of babul plantations in Berar by rats and a longicorn beetle.

30. Predaceous and parasitic pests of the lac insect.

IV.—Forest Economy.

31. The enquiry into the utilization of the less valuable kinds af timber as railway sleepers will be continued and a practical experiment is being made with sleepers obtained from Dipterocarpus sp. from Burma and the Andamans.

32. Enquiry will continue into the subject of :—

(*a*) Woods suitable for the manufacture of matches.
(*b*) Cultivation of lac.
(*c*) Antiseptic treatment of timber, particularly for railway sleepers.
(*d*) Utilization of various oil seeds from forest trees.
(*e*) Timbers at present little known which it is desired to bring to notice.
(*f*) Utilization of Xylia dolabriformis waste for paving blocks.
(*g*) Woods for lead pencils.
(*h*) Woods for cricket bats.
(*i*) Yew wood for archery.
(*j*) Woods for tea boxes.
(*k*) Camphor from Blumea balsamifera.
(*l*) Cultivation of Podophyllum Emodi.
(*m*) Cutch.
(*n*) Destructive distillation of wood in conjunction with the Imperial Forest Chemist.
(*o*) Walnut "Burrs".
(*p*) Rubber cultivation.
(*q*) Investigation into the physical properties and seasoning powers of various woods.
(*r*) Utilization of the oil of Schleichera trijuga.
(*s*) Trial of woods suitable for brush backs and tobacco pipes.

(*t*) Utilization of gum resins.

33. Investigations will be made into the following subjects :—

(*a*) Actual process and prospects of the manufacture of matches as a commercial enterprise.

(*b*) Best sites for the establishment of match factories and available supply of timber suitable for the manufacture of matches.

(*c*) Wood-pulp industry.

(*d*) Wood suitable for the manufacture of casks, packing cases and opium chests.

(*e*) Powellizing inferior woods.

(*f*) Padauk wood from the Andamans. Cause of falling off in demand, and possible measures for stimulating it.

V.—Forest Botany.

34. Enquiry into the following subjects will continue :—

(*a*) Study of the coppicing of teak, its effect on the normal health and development of the tree.

(*b*) The grasses of the Savannah tracts in Bengal will be examined with special reference to their difference in burnt and unburnt areas.

(*c*) A study will be made of the timber of different species of *tun* and *Grewia* to ascertain which yield the most valuable wood.

(*d*) Investigation (in the Madras Presidency) into the subject of the rising of marks on tree stems, used to indicate fixed levels of measurement in sample trees or plots.

35. The following subjects will receive attention :—

(*a*) Study of Teak reproduction.

(*b*) Study of Sal reproduction.

(*c*) Study of Forest grasses.

(*d*) Rearrangement and putting in order of Saharanpur Herbarium (located at Dehra Dun).

(*e*) Putting in order the Kaunli garden for research purposes in conjunction with the Sylviculturist.

VI.—Forest Chemistry.

36. Further examination of tannin extracts will be made specially the tannin extracted from mangrove at the Rangoon works with a view to its decolourization.

37. The collection and analysis of the latices of rubber producing species will be continued.

38. The following subjects will continue to be worked at :—

(*a*) The analysis of oil seeds for their oil values and oil cake utilization. (It is hoped the results will be embodied in a pamphlet). Analysis of resin and lac.

(*b*) Experiments with the newly designed camphor still and the distillation of camphor from Blumea balsamifera of Burma.

(*c*) Investigation (in Burma) into the various species of Compositæ as to their suitability for the production of camphor or any other valuable essential oil.

(*d*) Investigations into the active principles of the Nim tree (Melia Indica).

(*e*) Investigation into Catechu with a view to prepare Catechin-free Cutch on a commercial scale will be continued.

(*f*) Investigation into the manurial value of the various leaves, twigs and shrubs indigenous in the Madras Presidency, in order to ascertain the proportion of nitrogen and phosphoric acid, etc., which they contain.

39. Enquiry will be made into the following subjects :—

(*a*) The effect of differences of soil on production of the resin in Podophyllum Emodi.

(*b*) Investigation into the destructive distillation of wood in conjunction with the Imperial Forest Economist.

(*c*) Rusa grass oils, their distillation and chemical nature with a view to improve the great forest industry of the Central Provinces.

(*d*) Calorific power of different Indian timbers.

VII.—General.

40. Pamphlets, circulars, as well as the Memoirs and Records of the Forest Department, setting forth the results of investigations into various subjects affecting the progress of Indian Forestry, will be published from time to time.

APPENDIX V.

ANNUAL FORM No. 67.

FOREST DEPARTMENT, INDIA.

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1908-09.

BUDGET HEADS.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
1	2	3	4	5	6	7
REVENUE.	R	R	R	R	R	R
I.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY GOVERNMENT AGENCY—						
a. Timber	...	...	...	...	...	...
b. Firewood and charcoal	...	...	...	...	...	...
c. Bamboos	...	...	...	...	...	...
d. Sandal-wood	...	...	...	...	...	...
e. Grass and other minor produce	...	...	...	...	...	...
TOTAL I	...	...	...	...	...	...
II.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY CONSUMERS OR PURCHASERS—						
a. Timber	...	...	...	...	...	...
b. Firewood and charcoal	...	...	...	...	...	...
c. Bamboos	...	...	...	...	...	...
d. Grazing and fodder Grass	...	...	...	...	...	...
e. Other minor produce	...	...	...	...	...	...
f. Forest stamps	...	...	...	...	...	...
g. Other items	...	...	...	...	...	...
h. Commutation fees	...	...	...	...	...	...
TOTAL II	...	...	...	...	...	...
III.—DRIFT AND WAIF WOOD AND CONFISCATED FOREST PRODUCE	...	...	...	...	...	...
TOTAL III	...	...	...	...	...	...
IV.—REVENUE FROM FORESTS NOT MANAGED BY GOVERNMENT—						
a. Duty on foreign timber and other forest produce.	...	...	...	...	...	...
b. Revenue from shared and private forests.	...	...	...	...	...	...
TOTAL IV	...	...	...	...	...	...
V.—MISCELLANEOUS—						
a. Fines and forfeitures	...	...	...	...	...	...
b. Refunds	39	...	...	...	...	39
c. Other sources	...	...	...	1	7	8
TOTAL V	39	...	...	1	7	47
GRAND TOTAL REVENUE	39	...	...	1	7	47

APPENDIX V.

ANNUAL FORM NO. 67.

FOREST DEPARTMENT, INDIA.

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1908-09—continued.

BUDGET HEADS.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
1	2	3	4	5	6	7
EXPENDITURE.						
A.—CONSERVANCY AND WORKS.	R	R	R	R	R	R
I.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY GOVERNMENT AGENCY—						
a. Timber	...	...	...	...	...	...
b. Firewood and charcoal	...	...	...	...	...	...
c. Bamboos	...	...	...	...	...	...
d. Sandal-wood	...	...	...	...	...	...
e. Grass and other minor produce	...	...	...	...	...	...
TOTAL A. I	...	...	...	...	...	...
II.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY CONSUMERS OR PURCHASERS	...	...	...	...	...	...
TOTAL A. II	...	...	...	...	...	...
III.—DRIFT AND WAIF WOOD AND CONFISCATED FOREST PRODUCE	...	...	...	...	...	...
TOTAL A. III	...	...	...	...	...	...
IV.—REVENUE FROM FORESTS NOT MANAGED BY GOVERNMENT—						
a. Duty on foreign timber and other forest produce.	...	...	...	...	...	...
b. Revenue from shared and private forests.	...	...	...	...	...	...
TOTAL A. IV	...	...	...	...	...	...
V.—RENT OF LEASED FORESTS AND PAYMENTS TO SHAREHOLDERS IN FORESTS MANAGED BY GOVERNMENT	...	...	...	...	...	...
TOTAL A. V.	...	...	...	...	...	...
VI.—LIVE STOCK, STORES, TOOL AND PLANT—						
a. Purchase of cattle	...	...	...	...	...	...
b. Feed and keep of cattle	...	...	...	...	...	...
c. Purchase of stores, tools and plant.	125	144	859	985	6,429	8,542
TOTAL A. VI	125	144	859	985	6,429	8,542
Carried over	125	144	859	985	6,429	8,542

APPENDIX V.

ANNUAL FORM No. 67.

FOREST DEPARTMENT, INDIA.

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1908-09 —continued.

BUDGET HEADS.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
1	2	3	4	5	6	7
	R	R	R	R	R	R
Brought forward .	125	144	859	985	6,429	8,542
VII.—COMMUNICATIONS AND BUILDINGS—						
a. Roads and bridges . . .	...	...	...	...	...	...
b. Buildings	...	...	...	...	...	...
c. Other works	...	...	2	...	...	2
TOTAL A. VII .	...	...	2	...	...	2
VIII.—ORGANIZATION, IMPROVEMENT AND EXTENSION OF FORESTS—						
a. Demarcation	...	...	...	...	...	...
b. Cost of Forest Settlements; compensation for land and rights.	...	...	...	...	...	...
c. Surveys	...	...	...	...	...	...
d. Working-Plans . . .	...	...	...	...	...	...
e. Sowing and planting . .	...	...	...	...	...	...
f. Protection from fire . .	...	...	...	...	...	...
g. Other works	...	...	...	...	...	...
TOTAL A. VII .	..	...	...	...	...	...
IX.—MISCELLANEOUS—						
a. Law charges	...	...	...	...	...	...
b. Other charges	1	849	378	1,312	1,678	4,218
TOTAL A IX .	1	849	378	1,312	1,678	4,218
TOTAL A.—CONSERVANCY AND WORKS	126	993	1,239	2,297	8,107	12,762
B.—ESTABLISHMENTS.						
I.—SALARIES—						
a. Conservators	..	...	...	..	...	...
b. Superior officers . . .	13,500	10,500	12,300	9,642	4,500	50,442
c. Subordinate forest and depôt establishments.	...	...	...	...	...	...
d. Office establishments . .	4,393	2,404	2,626	1,664	1,089	12,176
e. Deputation and special allowances	1,710	3,000	2,800	1,776	...	9,286
f. Exchange compensation allowance.	...	...	...	2	...	2
TOTAL B. I .	19,603	15,904	17,726	13,084	5,589	71,906

APPENDIX V.

ANNUAL FORM No. 67.

FOREST DEPARTMENT, INIDA.

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1908-09—concluded.

BUDGET HEADS.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
1	2	3	4	5	6	7
	R	R	R	R	R	R
II.—TRAVELLING ALLOWANCES—						
a. Conservators	...	...	...	...	...	...
b. Superior officers	1,428	1,085	1,131	894	979	5,517
c. Subordinate forest and depôt establishments.	...	...	...	...	...	...
d. Office establishments	335	133	512	114	487	1,581
TOTAL B. II	1,763	1,218	1,643	1,008	1,466	7,098
III.—CONTINGENCIES—						
a. Stationery	38	23	50	41	16	168
b. Carriage of tents and records	569	154	872	116	220	1,431
c. Rents, rates and taxes	...	1,510	485	...	...	1,995
d. Pay of police-guards	...	...	...	...	...	...
e. Official postage	159	120	310	195	102	886
f. Sundries	271	1,211	477	1,769	1,225	4,953
Compensation for dearness of Provisions.	15	28	37	21	10	111
TOTAL B. III	1,052	3,046	1,731	2,142	1,573	9,544
TOTAL B.—ESTABLISHMENTS	22,418	20,168	21,100	16,234	8,628	88,548
Add TOTAL A—CONSERVANCY AND WORKS.	126	993	1,239	2,297	8,107	12,762
GRAND TOTAL OR EXPENDITURE	22,544	21,161	22,339	18,531	16,735	1,01,310
SURPLUS OR DEFICIT	—22,505	—21,160	—22,339	—18,530	—16,728	...

M. GHATAK,
Deputy Comptroller, India Treasuries.

CALCUTTA,
The 22nd August 1909.

APPENDIX VI.

FORM No. 68.—[*Prescribed.*]

FOREST DEPARTMENT, INDIA.

Account Current of the Imperial Forest Research Institute for Forest year 1908-09.

RECEIPTS.

	Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.
Cash Balance	28 14 9	...	...	641 12 6	48 4 0	718 15 3
VIII—Assessed Taxes—						
Income Tax—Deductions from salaries	439 6 10	316 10 8	335 2 6	231 14 10	117 3 0	1,440 5 10
Revenue during the Forest year 1908-09	38 9 4	...	...	0 14 0	6 14 0	46 5 4
Forest Advances	663 11 3	1,416 1 0	2,676 2 5	2,366 0 3	2 536 14 10	9,658 13 9
Suspense Account	...	...	3 10 6	...	...	3 10 6
Service Funds—						
Uncovenanted Service Family Pension Fund, Bengal.	...	411 5 0	...	...	...	411 5 0
Savings Bank Deposits—						
Bank Account—						
Forest Officers' Provident Fund	1,350 0 0	1,200 0 0	1,230 0 0	966 0 0	...	4,746 0 0
Special Account—						
General Family pension Fund	...	...	...	...	...	...
Cash Remittances—Local—Forest Remittances—						
Forest cheques drawn	67 6 9	605 14 3	305 8 2	437 3 6	79 15 6	1,496 0 2
Revenue Remittances written back	...	...	...	...	...	...
Inter-divisional Transfers	...	...	...	...	...	...
Exchange Account with other Governments—						
Account between India and Central Provinces—						
III.—Items adjustable by India	...	...	50 0 0	...	...	50 0 0
IV.—Items adjustable by Central Provinces.	...	...	...	...	...	...
Account between India and Burma—						
III.—Items adjustable by India	...	...	...	...	...	...
IV.—Items adjustable by Burma	...	...	...	...	...	...
Account between India and Eastern Bengal and Assam—						
III.—Items adjustable by India	...	...	...	...	...	...
IV.—Items adjustable by Eastern Bengal and Assam.	...	...	...	...	...	...
Account between India and Bengal—						
III.—Items adjustable by India	...	...	...	...	...	...
IV.—Items adjustable by Bengal	...	...	...	...	...	...
Account between India and United Provinces of Agra and Oudh—						
III.—Items adjustable by India	20,707 12 2	18,317 14 0	20,623 7 6	16,075 11 5	15,529 14 6	92,254 11 7
IV.—Items adjustable by United Provinces of Agra and Oudh.	...	...	...	...	...	...
Account between India and Punjab—						
III.—Items adjustable by India	...	...	...	...	...	...
IV.—Items adjustable by Punjab	...	...	...	...	...	...
Account between India and Madras—	...	...	...	...	...	...
III.—Items adjustable by India	...	...	...	...	...	...
IV.—Items adjustable by Madras						
Account between India and Bombay—						
III.—Items adjustable by India	...	...	...	800 0 0	...	800 0 0
IV.—Items adjustable by Bombay	...	...	...	60 0 0	...	60 0 0
Inter-Departmental Transfers—						
Public Works Department, Ordinary Branches.	...	...	...	...	...	...
Public Works Department, Railway Branch	...	...	1 0 0	...	...	1 0 0
Military Department, Eastern Circle	...	28 11 0	5 0 6	62 11 11	23 11 9	120 3 2
" " Northern "	...	...	...	0 15 0	...	0 15 0
" " Western "	...	...	...	...	...	...
Telegraph Department	...	...	0 4 0	...	...	0 4 0
Post Office Department	...	31 8 0	...	...	15 11 0	47 3 0
Civil Departments	12 0 0	51 0 0	12 0 0	261 1 6	55 5 0	391 6 6
Marine Department	...	29 1 4	...	...	...	29 1 4
GRAND TOTAL	23,307 13 1	22,408 1 3	25,242 3 7	21,904 4 11	19,413 13 7	1,12,276 4

APPENDIX VI.

FORM No. 68.—[*Prescribed.*]

FOREST DEPARTMENT, INDIA.

Account Current of the Imperial Forest Research Institute for Forest year 1908-09.

PAYMENTS.

	Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist	TOTAL.
	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.	₹ a. p.
I.—Refunds and Drawbacks—						
Expenditure during the Forest year 1908-09	22,544 7 8	21,160 12 3	22,339 5 4	18,531 7 10	16,735 4 3	1,01,311 5 4
Forest Deposits	...	...	...	...	...	...
Forest Advances	670 11 1	1,245 5 0	2,899 3 9	2,475 0 10	2,671 11 4	9,962 0 0
Suspense Account	...	...	3 10 6	...	...	3 10 6
Savings Bank Deposits—						
Bank Account—						
Forest Officers' Provident Fund .	...	...	...	...	...	...
Cash Remittances—Local—Forest Remittances—						
Remittances to Treasuries .	...	...	...	...	...	...
Unpaid cheques written back .	...	...	...	...	...	...
Inter-divisional Transfers .	...	...	...	...	...	...
Account Current with Foreign States—						
Her Majesty's Colonial Government, Ceylon.	...	...	...	...	...	...
Exchange Account with other Governments—						
Account between India and Central Provinces—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Central Provinces.						
Account between India and Burma—	...	...	...	...	...	...
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Burma .	...	...	...	...	...	...
Account between India and Eastern Bengal and Assam—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Eastern Bengal and Assam.	...	...	...	...	...	...
Account between India and Bengal—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Bengal .	...	...	...	...	...	...
Account between India and United Provinces of Agra and Oudh—						
III.—Items adjustable by India .	38 9 4	2 0	...	27 8 8	6 14 0	75 0 0
IV.—Items adjustable by United Provinces of Agra and Oudh.	...	...	...	...	...	...
Account between India and Punjab—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Punjab .	...	...	...	...	...	...
Account between India and Madras—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Madras .	...	...	...	...	...	...
Account between India and Bombay—						
III.—Items adjustable by India .	...	...	...	...	...	...
IV.—Items adjustable by Bombay .	...	...	...	868 11 7	...	868 11 7
Inter-Departmental Transfers—						
Public Works Department, Ordinary Branches.	...	...	...	...	...	...
Public Works Department, Railway Branch.	...	...	...	...	...	...
Military Department, Eastern Circle	...	...	...	...	...	...
„ „ Northern „	...	...	...	...	...	...
„ „ Western „	...	...	...	...	...	...
„ „ Secunderabad Circle.	...	...	...	...	...	...
Telegraphic Department . .	...	...	...	...	...	...
Post Office „ . .	...	...	...	...	...	...
Marine Department . . .	...	...	...	...	...	...
Civil Departments . . .	...	...	...	...	...	...
Cash Balance . . .	54 1 0	...	...	1 8 0	...	55 9 0
GRAND TOTAL .	23,307 13 1	22,408 1 3	25,242 3 7	21,904 4 11	19,413 13 7	1,12,276 4 5

APPENDIX VII.

ANNUAL FORM No. 70.—[*Prescribed.*]

FOREST DEPARTMENT, INDIA.

Outstandings and Liabilities on account of Contractors and Disbursers for Forest year 1908-09.

Division.	DEPARTMENT DEBTOR.			DEPARTMENT CREDITOR.			BALANCE DUE.		REMARKS.
	At commencement of year.	Recoveries in cash and value of supplies and work done during the year.	At close of year.	At commencement of year.	Payments made during year.	At close of year.	To Department (Outstandings).	By Department (Liabilities.)	
1	2	3	4	5	6	7	8	9	10
	℞ a. p.	℞ a. p.	℞ a. p.	℞ a. p.	℞ a. p.	℞ a. p.	℞ a. p.	℞ a. p.	
Superintendent of Working-Plans.	...	663 11 3	663 11 3	5 2 11	670 1 0	675 14 0	12 2 9		
Forest Botanist.	...	1,416 1 0	1,416 1 0	255 11 5	1,245 5 0	1,501 0 5	84 15 5		
Forest Zoologist.	...	2,676 2 5	2,676 2 5	88 10 1	2,899 3 9	2,987 13 10	311 11 5		
Forest Economist.	...	2,366 0 3	2,366 0 3	302 5 11	2,475 0 10	2,777 6 9	411 6 6		
Forest Chemist.	...	2,536 14 10	2,536 14 10	250 0 0	2,671 11 4	2,921 11 4	384 12 6		
TOTAL	...	9,658 13 9	9,658 13 9	901 14 4	9,962 0 0	10,863 14 4	1,205 0 7		

M. GHATAK,
Deputy Comptroller, India Treasuries.

CALCUTTA,
The 22nd August 1909.

104 P. I. F. C.—Exd.

PROGRESS REPORT

OF THE

IMPERIAL FOREST RESEARCH INSTITUTE

FOR

1909-1910.

134461

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1910

Progress Report of the Imperial Forest Research Institute for the Forest year 1909-10.

CHAPTER I.

Administration.

Mr. A. M. F. Caccia, M.V.O., Officiating Conservator of Forests, held the post of President from 1st July 1909 to 5th December 1909, when he was relieved by Mr. L. Mercer, the permanent incumbent of the post, on his return from furlough.

The following statement gives the names of the officers who held charge of the various branches of the Forest Research during the year:—

Branch of the Forest Research Institute.	Dates.		Name of officer in charge of branch.
	From	To	
Working-Plans and Sylviculture.	1st July 1909 . .	30th June 1910 . .	Mr. R. S. Troup, F.C.H., Deputy Conservator of Forests.
Forest Zoology . .	1st July 1909 . .	4th December 1909 .	Mr. E. P. Stebbing, Deputy Conservator of Forests.
	5th December 1909 .	30th June 1910 . .	Mr. V. Subramania Iyer, M.A., Extra Assistant Conservator of Forests.
Forest Botany . .	1st July 1909 . .	27th April 1910 . .	Mr. R. S. Hole, F.C.H., Deputy Conservator of Forests.
	28th April 1910 . .	30th June 1910 . .	Mr. C. M. McCrie, F.C.H., Deputy Conservator of Forests.
Forest Economist .	1st July 1909 . .	30th June 1910 . .	Mr. R. S. Pearson, Deputy Conservator of Forests.
Forest Chemist . .	1st July 1909 . .	23rd October 1909 .	Mr. Puran Singh.
	24th October 1909 .	30th June 1910 . .	Mr. B. O. Coventry, F.C.H., Deputy Conservator of Forests.

The President regrets that it has not been found possible to fill all the above posts with Imperial Service officers as was originally intended, but the claims of education were paramount, and posts at the Imperial Forest College have had to be filled at the expense of the Institute.

CHAPTER II.

Section 1.—The Work of the Institute.

The President would invite a reference to the remarks made last year under this head with which he generally agrees. The work of tuition and instruction of students especially in camp has been lighter owing to the appointment of three Imperial Instructors which dates from the commencement of the last cold weather. This has set free the officers of the Institute for their own special work—they no doubt have to devote a certain amount of time to lectures during the rains sessions of the College, but this cannot form any reasonable ground of complaint: on the contrary it may be said to be an advantage as tending to keep specialists up to date and well read in their various subjects. In every branch work is showing an increase, indeed it would be surprising if this were not so and considerable expansion must be yearly counted upon as the Institute becomes better known and its work more largely appreciated. The desideratum is to confine actual office work within as narrow limits as possible so as to afford officers more time for touring and research proper, this is being kept in mind and long official letters between the branches and the President discouraged in favour of short unofficial memoranda and notes.

Section 2.—Investigations and Research in the various branches.

Sylviculture and Working-Plans.

These two branches were combined more than two years ago. The President has always been in favour of this combination as the work of one runs into that of the other. Though in the first instance somewhat adversely criticized, experience is showing that

this combination is on the right lines, and the officer holding the combined posts is satisfied that this is so, provided of course he be given sufficient staff to efficiently carry out a dual programme. The work done during the year in accordance with the sanctioned programme may be summarized as follows:—

(1) The compilation of a number of statistics relating to teak forests; these will be published shortly.

(2) Selection on the ground of areas containing well stocked fairly even aged crops of sal in the forests of the United Provinces with a view to laying out sample plots in them when establishment becomes available, (as is now the case), for the purposes of measuring volumes of whole woods, establishing quality classes, and ascertaining the degree of thinning called for under various conditions.

(3) Certain figures have been collected with regard to yield tables of various species, but some time must elapse before anything under this head is ready for publication.

(4) Considerable information was collected with regard to the application of the "uniform method" to various types of Indian forests. A sample area of over 4,000 acres is now being made over to the Research Institute and College for the execution of forest operations, (though the revenue and expenditure will remain in the hands of the Conservator of the Province), at Thano in the Dehra Dun district where this method is to be applied. The President however does not consider the area as the best possible sample and if it had not already been decided upon would not press for its cession to the Institute and College: it is situated at the western limit of the sal belt and conditions are entirely different to what obtain in the sal forests of Bengal and elsewhere. Still it will no doubt yield statistics of a certain value.

(5) Registers of sample plots were maintained for the record of girth measurements carried out by local officers. These have not however been entirely trustworthy in the past.

Registers have also been opened with the object of recording volume measurements on the staff necessary for this being available.

(6) Ledger files have been opened for the record of information affecting Sylviculture while information on plantation work is also being collected.

(7) Somewhat extensive experiments on the coppicing of dak trees (*Butea frondosa*) with a view to lac propagation. Any definite results cannot however be apparent for a considerable time.

(8) The experimental cultivation of *Podophyllum Emodi* in Jaunsar is being carefully watched—the growth is very slow.

Outside the sanctioned programme various notes were recorded by the Sylviculturist while on tour, these have all been ledgered systematically; much more work might have been done had an adequate establishment been provided, but owing to want of funds such was not possible.

In this branch especially years must often elapse before the results of any special investigation can be given to the public.

The Sylviculturist was on tour in the forest of the United Provinces for more than four months, while he was away for three weeks attending a forest conference at Maymyo, Burma. During his first two months of touring he gave valuable instruction to the College students in addition to his own research work.

Mr. Troup acknowledges the help given by Forest Officers generally and states that requests for information or assistance are on the increase. A certain proportion of his time was taken up with the Working-Plans work of the Inspector General's office. It is understood that proposals are being made to relieve him of this work. He will thus be enabled to devote his energies more entirely to the Institute.

Forest Botany.

Mr. Hole held this post till the end of April when he went on well merited furlough, Mr. McCrie from that date holding charge of the current duties of the office.

The principal work carried out was:—

(1) Investigation (continued) on the effect of coppicing on the normal growth and development of teak—this investigation is still incomplete, but a preliminary note on the subject was published during the year.

(2) Investigation into the various forest grasses was completed. A memoir on the subject will shortly issue. This will prove of exceptional interest dealing as it does *inter alia* with fodder grasses, with the effect of firing

grass areas, with tree species which can be introduced with promise of success depending on the dominant species of grass found in the locality.

(3) The study and classification of the "*Grewias.*" This is approaching completion and though of more or less academic interest to the Forest Department will prove a valuable addition to contemporary literature on the subject.

(4) Investigations being carried out in the experimental garden lately established at Chandbagh with a view to discovering the factors primarily responsible for the dying back of sal and teak seedlings. As far as this investigation has proceeded it appears not improbable that this dying back depends greatly on the quantity of moisture in the soil.

(5) The rearrangement of the herbarium. This is on the point of completion.

Mr. Hole was not on tour during the year, the writing up of his notes and working up the information that he had collected necessitating his presence at head-quarters. During the year he named many species for various Forest Officers and others and received valuable assistance from members of the Department.

Forest Economy.

The work of the Imperial Forest Economist has been very varied and was probably heavier than in any other branch. It is also of the most interesting character as bringing the Economist into close touch with the mercantile world as well as with scientific Institutions. The principal work done has been:—

(1) Powellizing of railway sleepers. The point reached is that the Governments of Bombay, the United Provinces and Burma have been asked to prepare and supply the sleepers, delivering them at Bombay, 1,000 each of the following kinds:—

Pinus longifolia.
,, *excelsa.*
Terminalia tomentosa.
Dipterocarpus tuberculatus.
Dipterocarpus alatus.

It is believed that favourable replies are forthcoming from the Governments concerned. During this enquiry it has come to light that of species laid down in 1907 as sleepers, *viz., Pinus excelsa, Abies Pindrow, Pinus longifolia* and *Picea Morinda,* none have a life of over $2\frac{1}{2}$ years untreated, the blue pine being probably the most lasting.

(2) Investigation as to the suitability of *Xylia dolabriformis* for street paving. This timber has been laid down in Rangoon but no results are yet apparent.

(3) The following woods have been found suitable for pencils: *Podocarpus periifolia, Cedrus deodara, Cupressus torulosa, Wrightia tomentosa* and *tinctoria.*

(4) *Sonneratia apetala* was found suitable for packing cases, with the result that saw mill agents in Calcutta have asked for 2,000 to 3,000 logs.

(5) Various woods were tested for minor industries such as tool handles, mathematical instruments, cricket bats, cotton mill rollers, knife handles, brushes, pipes, fishing rods, etc., with various results.

(6) The commercial value of camphor from *Blumea balsamifera* and *Cinnamomum glanduliferum* was investigated—the former is of little value—the latter is somewhat more promising.

(7) Many tons of *Podophyllum Emodi* have apparently been indented for, tending to show that investigations made and replies to enquiries have been useful to the trade.

(8) The progress of match factories in India is being carefully watched and every assistance given to enquiries.

(9) Pulp Industry. This is promising; much information regarding the cost and possibilities of bamboo supplies has been collected in Bombay and Madras. Some 80 tons of bamboos are being supplied to the Calcutta mills for experimental purposes. It is hoped to deal extensively with this subject in the report for 1910-11, as well as in a special publication.

(10) Various minor enquiries are in progress; such as the utilization of gum resins, value of "*Ficus elastica*" rubber, methods of preserving woods against decolorization, technical properties of certain woods.

(11) Prominence must be given to the investigations on the antiseptic treatment of timbers. Specimens have been treated with antiseptics known as *Atlas, Solignum, tar, Pinus excelsa oil, Avenarius carbolineum, Green oil,*

Jodleite, Cresoyle, Hylinite, etc. These are laboratory tests only, but so far as experiments have gone, species so treated show signs of lasting well when placed in the ground, while untreated samples of the same species have in many instances perished. Laboratory experiments were also carried out as regards the fissibility of various species, the absorbent power of various timbers with regard to antiseptic solutions, (a factor in the cost of such treatment), experiments in seasoning, prevention of splitting, and on the strength, expansion and shrinkage of timbers.

The Economist was on tour for some six months during the year in the United Provinces, Bengal, Bombay and Madras, collecting data, visiting bamboo tracts and spruce and silver fir areas in connection with paper pulp.

Enquiries received both from the Department and from outside it were very voluminous. The outside public not infrequently appears to consider the Economist as a general enquiry agent, bursting with knowledge on subjects often totally unconnected with his branch. It is believed that his replies have warranted their continued confidence and that he has successfully upheld his reputation.

Forest Chemistry.

The work of the Chemist consists as much in assisting other members of the Institute, especially the Economist, as of original work of his own. This was very much in evidence during the past years. The following was the more important work carried out in this branch:—

(1) Experiments at Rangoon to decolorize and render acceptable to the trade the tannin extract derived from Mangrove bark (*Rhizophora mucronata*). The Assistant Chemist to whom this experiment was entrusted was at Rangoon for the best part of three months. Samples of the extract were sent to various firms and their replies were beginning to come in at the close of the year. Three samples hold out some promise of success, as it is believed that the defects pointed out in them will not be difficult to eradicate though whether this Mangrove bark extract will ever be of great commercial value is open to some doubt as the cost of preparation is comparatively high while the price that may be expected for the extract is a moderate one. An extract made from sal bark gave poor results.

(2) Distillation of camphor from *Blumea balsamifera.* The product was sent to Europe for opinion, the conclusion come to being that the price was too low for it ever to be a commercial success.

(3) Charcoal and woods were tested as to their calorific value. A note embodying the result arrived at was put up at the end of the year.

(4) Extraction of oil from various oil-seeds. Little progress could be made in this owing to the want of an hydraulic oil press. One it is hoped will arrive shortly from England. Outside the sanctioned programme, Mr. Puran Singh proceeded in the hot weather to Manbhoom to advise Messrs. Arathoon, the owner of a shellac factory there, on the manufacture of shellac. A model apparatus was constructed by Messrs. Arathoon on lines recommended by the Assistant Chemist, but was found to be defective when put to the test of actual working owing to its having been badly constructed. The process as explained by Mr. Puran Singh gave, however, in Messrs. Arathoon's opinion considerable promise of success. Nothing further was done towards testing the manufacture of shellac by the *Methyl alcohol* process owing to there being no plant available. It was hoped that the Rewah State might put up such a plant, but nothing has yet been done. The great difficulty that meets the Chemist is the fact that though laboratory experiments may hold out every hope of success, there is no opportunity of putting them to actual proof on a commercial scale, and unless parties are satisfied that success can be obtained on a commercial scale they are unwilling to put up a costly plant.

The Assistant Chemist also paid a visit to the turpentine factory at Bhowali, United Provinces. The complaint of the trade was that the locally manufactured article left a sticky residue on evaporation. This has been successfully got rid of.

Samples of turpentine prepared at Bhowali were variously reported on—one sample appears easily saleable, but its preparation is somewhat costly—another sample obtained by mixing the crude oleo resin before distillation with a small proportion of a low boiling medium gave a satisfactory chemical analysis, but was not so well received. Endeavours are being made to find out on what the objection to it rests. As regards the turpentine bye-product—the colophony—samples of various shades were prepared and sent to various Indian firms for valuation: the results are not yet to hand. Other minor investigations were carried out, such as camphor extraction from *Cinnamonum*

glanduliferum. This is fairly well reported on, but further data are necessary and enquiries as to its value have been placed in the hands of the Economist, who is also collecting data with regard to Kusam (*Schleichera trijuga*) oil for soap-making. The North-West Soap Company have reported well on the refined sample.

In addition to laboratory work many enquiries were replied to. The work of the laboratory was somewhat hampered for want of staff.

The Forest Chemist was prevented by his educational duties from taking active part in research work, and was on tour with the students almost continuously from November to June.

The Assistant Chemist was some five months on tour, principally at Rangoon, Manbhoom, Cawnpore and Bhowali. He received cordial assistance in the way of specimens from officers of the Department.

Forest Zoology.

Mr. Subramania Iyer took charge of this branch from Mr. Stebbing in December last when the latter proceeded on long furlough.

The work carried out principally consisted in the collection of data and enquiry into the life histories of insects infesting the sal areas. What progress was made it is difficult to say as the file on the subject was not available. Similarly it is difficult to say what progress has been made in investigating the insects attacking the chir pine, as little has been left on record; a publication on the subject, however, is shortly expected to issue. Generally it may be said that some progress took place in this branch of the Institute, but there is no or very little information available in the office of the Zoologist as to the extent of this progress; Mr. Stebbing is about to publish certain results of his investigations.

Outside the sanctioned programme some plantations at Chaunkot in the Garhwal Division were found to be attacked by the *Cryptorrhynchus Brandisii*, remedial measures were suggested.

In the Dechauri Range, Kumaon Division, United Provinces, young sal seedlings were badly attacked by a caterpillar which turned out to be the *Pammene thiristis*, this is still under investigation. Many enquiries were received—the one referring to the insect attack in the Simla catchment area was interesting. This attack appears to have ceased to a large extent; it was very possibly due to a partial failure of rain in the previous monsoon rendering the trees weakly and liable to attack. A similar case occurred in the Naini Tal forests, where with a good rainy season following the attack, it ceased. There is no doubt that drought or partial drought favours and may often, if not generally, be said to be responsible for insect attacks by rendering the trees sickly and weakly and that nature generally provides its own remedy by a normal or plentiful rainfall in the following season.

The Entomologist visited the *Casuarina* plantations of Nellore in the hot weather and a note on the subject of insect attack is under preparation. He spent between three and four months on tour, chiefly at Calcutta, Pusa and the East Coast of Madras. His principal occupation has been the formation and maintenance of a good reference collection, classifying and cataloguing the specimens. They are now arranged in fairly good order. Much assistance was received from Mr. Lefroy and Dr. Annandale, the former presented 162 insects to the Institute, while the latter assisted in every way he could. The want of a competent staff was here as in other branches severely felt.

Many specimens have latterly been received from members of the Department as well as some very interesting data. Naturally, however, comparatively little is known of our forest insects; it is difficult to imagine a field of study more attractive to a real enthusiast.

Section 3.—Collections and Records.

(*a*) *Museums and Collections.*

Botany collection.—This is probably the best in Northern India. During the year 512 additions were made, and duplicates were exchanged. The collection is now in good order and reflects credit on Mr. Hutchinson in whose charge it is under the orders of Mr. Hole.

Mr Keshavanand, Rai Bahadur, who was appointed a College Instructor in April, brought with him a collection of Kashmir species numbering some 1,800 specimens which he has most kindly presented to the Institute. There has as yet been no time to incorporate this in the herbarium, but steps are being taken to do so gradually as opportunity offers. This is probably the finest collection made by any Provincial Service officer. A small representative collection is being formed or improved for the instructional work of the College and will be located at the College. The existing collection for this purpose was defective.

Zoological collection.—Mr. Subramania Iyer has devoted much attention to this and has in the short time he has been the Entomologist greatly improved it and has managed to name a number of specimens. He has had the greatest assistance from Mr. Lefroy and others, while scientists at home, notably Messrs. Meyrick and Lewis, and M. Grouvelle of Paris, have always been ready to help in identification. The visits paid by Mr. Subramania Iyer to Pusa and to the Calcutta museum were of great service to him. This collection is however far from representative and years of patient study must elapse before it can be made so.

Forest Economic products collection.—This was under the able control of Mr. Pearson and has been materially improved and most satisfactorily arranged—Mr. Pearson takes great pride in this section of his work and from both officers of the Department and others he is daily receiving valuable additions, in fact so many specimens come in at times that it is difficult to find leisure to arrange and classify them.

Sylviculture.—At present there is no space available for such a collection, this defect will however be remedied as time goes on.

(*b*) *Ledgers.*

In the *Sylviculturist's* branch complete ledger files are being compiled for all branches of Sylvicultural information under different heads. As Mr. Troup remarks the initial work is very great, but he quite realises the fact that when these files are completed the labour involved will be amply repaid by the increased value of the Sylviculturist's office as a bureau of information. This is the right view to take of it.

In the *Botanist's* office, no regular ledger files are perhaps required so long as all useful information is not lost sight of.

In the *Economist's* branch the ledgering of all important information is systematically kept up. The work involved is heavy and at times it is difficult to keep it up to date. Complete ledgers for all important information are more urgently required in this branch than in any other. If the files of the Reporter on Economic Products are ever transferred here the establishment will have to be strengthened, it is already working at full pressure.

In the *Chemist's* branch a register is maintained on which the results of laboratory research work are recorded, while notes are kept up, referring to matter likely to be of service that appears in the Chemical Journals. This is as much as is at present required.

In the *Zoologist's* branch matters are not wholly satisfactory. Some time ago orders were given that notes on all insects, etc., under observation or investigation or met with on tours were to be recorded in ledgers. This procedure was discontinued while the President was on leave last year with the result that there is practically no record of what has been done, outside published papers and articles. The previous orders have now come into force again and care will be taken that they are not allowed to lapse.

(*c*) *Library.*

The reclassification was completed satisfactorily during the year by Mr. Nand Mal, Extra Deputy Conservator, and rules as to issue of books, etc., issued and printed. The greatest number of purchases were made for the Botanical library, 213 new volumes being purchased for that section.

(*d*) *Publications.*

Below is a list of publications put in type during the year under review, showing those which were actually issued from the Press during the year and those which were still in the Press at its close. It has been impressed on all members of the Institute that publications are not to be lightly undertaken or rushed through the Press on insufficient data. This warning was not uncalled for.

List of Forest Publications put into type during the Forest year 1909-10.

Branch of Research.	Name of Publications.	Author.	Form in which issued.	Remarks.
	I.—Leaflets.			
Zoology .	*Scolytus major* . . .	E. P. Stebbing .	Leaflet No. 4 .	Issued in 1910.
Do. .	*Polygraphus major* . .	Do. .	Do. 5 .	Do.
Do. .	*Tomicus Ribbentroppi* . .	Do. .	Do. 6 .	In Press.
	II.—Pamphlets.			
Do. .	Note on the Preservation of Bamboos from the attacks of the Bamboo beetle or shot-borer.	Do. .	Pamphlet No. 15, Zoology Series No. 2.	Issued in August 1910.
	III.—Records.			
Do. .	Note on some Insect Pests of the Himalayan Oaks.	Do. .	Record, Vol. II, Part 1.	Issued in August 1909.
	IV.—Memoirs.			
Do. .	Second Monograph on some undescribed *Scolytidæ* of economic importance from the Indian Region, II.	Do. .	Memoir, Vol. I, Part II.	Issued in November 1909.
Do. .	Note on some Insect Pests of the Himalayan Coniferæ, Part I (treating Deodar).	Do. .	Memoir . .	In Press.
Do. .	Note on the Insect Pests of the Himalayan Coniferæ, Part II (*Pinus longifolia*).	Do. .	Do. . .	Do.
Do. .	Second Edition of the Monograph on Lac Insect (*Tachardia Lacca*).	Do. .	Memoir, Vol. I, Part III.	Do.
	V.—Manuals.			
	Nil.			
	I.—Leaflets.			
Economy .	*Nil.*			
	II.—Pamphlets.			
Do. .	Note on Burmese *Leza* Wood.	R. S. Troup . .	Pamphlet No. 10, Economy Series No. 3.	Issued in October 1909.
Do. .	Note on Carallia Wood (*Carallia integerrima*).	Do. . .	Pamphlet No. 11, Economy Series No. 4.	Do. do.
Do. .	Note on Burmese *In* Wood (*Dipterocarpus tuberculatus*).	Do. . .	Pamphlet No. 13, Economy Series No. 6.	Issued in December 1909.
Do. .	Note on Petwun or Trincomali Wood (*Berrya Ammonilla*).	Do. . .	Pamphlet No. 12, Economy Series No. 5.	Issued in February 1910.
Do. .	Note on Burma Padauk (*Pterocarpus macrocarpus*).	Do. . .	Pamphlet No. 14, Economy Series No. 7.	Issued in December 1909.
	III.—Records.			
Do. .	Note on the Fissibility of some Indian Woods.	Do. . .	Record, Vol. II, Part II.	Issued in 1910.
	IV.—Memoirs.			
Do. .	Note on the Prospects of Match Industry in India.	Do. .	Memoir, Vol. II, Part I.	Do.
	V.—Manuals.			
Do. .	Descriptive Catalogue for the Economic Museum of the Imperial Forest Research Institute and College.	R. S. Pearson . .	Manual . . .	In Press.
	I.—Leaflets.			
Working-Plan.	*Nil.*			

List of Forest Publications put into type during the Forest year 1909-10—contd.

Branch of Research.	Name of Publications.	Author.	Form in which issued.	REMARKS.
	II.—PAMPHLETS.			
Working-Plan.	The collection of Statistical Data relating to the principal Indian species.	A. M. F. Caccia .	Pamphlet No. 8, Working-Plan Series No. 2.	Issued in 1910.
Do. .	Tables showing the progress in Working-Plans.	Do. .	Pamphlet No. 9, Working-Plan Series No. 3.	Do.
	III.—RECORDS.			
	Nil.			
	IV.—MEMOIRS.			
	Nil.			
	V.—MANUALS.			
Do. .	Revised fourth edition of D'Arcy's preparation of Forest Working-Plans.	Do. . .	Manual . .	Issued in July 1910.
	I.—LEAFLETS.			
Sylvicultural Series.	*Nil.*			
	II.—PAMPHLETS.			
Do. .	Memorandum on Teak plantations in Burma.	F. A. Leete . .	Pamphlet . .	In Press
	III.—RECORDS.			
Do. .	Note on the Sylviculture of *Hardwickia binata* (Anjan).	D. O. Witt . .	Record, Vol. II, Part III.	Do.
	IV.—MEMOIRS.			
	Nil.			
	V.—MANUALS.			
Do. .	Manual of Sylviculture, Translation of Jacquot's "*Incendies en Forêts.*"	C. E. C. Fisher .	Manual . .	Do.
Do .	The practical determination of the girth increment.	R. S. Troup . .	Booklet . .	Issued in 1910.
	I.—LEAFLETS.			
Botany .	*Nil.*			
	II.—PAMPHLETS.			
Do. .	Note on Best Season for Coppice Fellings of Teak (*Tectona grandis*).	R. S. Hole . .	Pamphlet No. 16, Botany Series No. I.	Do.
	III.—RECORDS.			
Do. .	Notes on Sandal . . .	Rao Sahib M. Rama Rao Garu.	Record, Vol. II, Part III.	In Press.
Do. .	Note on Host Plants of Sandal Tree.	Do. . .	Record . . .	Do.
	IV.—MEMOIRS.			
	Nil.			
	V.—MANUALS.			
Do. .	Forest Flora of Chota-Nagpur	H. H. Haines .	Manual . .	Do.

Appendix I shows all publications issued since the Institute came into existence.

(*e*) *Indents.*

Appendix II shows the indents complied with for seeds, etc. These indents are placed with various Conservators, the Institute acting merely as a forwarding agent. There is some reason to think that Divisional Officers do not welcome this additional call on their time with much pleasure, and perhaps naturally so, although they have as a rule cheerfully complied with indents to the best of their ability.

(*f*) *Tours.*

These have been dealt with already when reviewing the work done in the various branches.

CHAPTER III.

FINANCIAL.

The expenditure of the past two years is compared below:—

Budget Head.		Expenditure during the year.		Difference + or —.
		1908-09.	1909-10.	
		Rs.	Rs.	Rs.
AVI.	Stores, Tools and Plant, etc.	8,542	12,384	+3,842
AVII.	Buildings, etc.	2	652	+650
AIX.	Miscellaneous Charges	4,218	7,073	+2,855
BI*b*.	Superior Officers	50,442	50,013	—429
BI*d*.	Office Establishment	12,176	17,094	+5,918
BI*e*.	Deputation and Special Allowances	9,286	7,914	—1,372
BI*f*.	Exchange Compensation Allowance	2	..	—2
BII.	Travelling Allowances	7,098	10,246	+ 3,148
BIII.	Contingencies	9,544	14,253	+4,709
	Grand Total of all Expenditure	1,01,310	1,19,629	+18,319

The increase under AVI was due to purchase of furniture, cabinets, etc., for the Institute Collections; under AVI to roads having to be kept in order and improved on the Chandbagh Estate recently purchased. Under AIX to increase of work in the Chemical Laboratory, purchase of chemicals, carriage of specimens, etc.; under BI*d* the increase was due to the reorganization of the office establishment; under BI*e* to no honoraria having been paid during the year and to the lower deputation allowance of the Forest Zoologist. The increase under BII was due to extensive touring made by Research Institute Officers and the appointment of an Imperial Service Officer as Chemist. Contingencies showed a substantial increase owing to extensive touring, purchase of books, etc.

The budget of 1910-11 underwent considerable curtailment on the figures accepted by the Inspector General of Forests. The President feels that he must enter a respectful protest against some of these reductions which often defeat their own object. It is doubtful economy to pay considerable salaries to expert officers and then find that it is impossible to utilize their services to the full owing to a staff competent to assist them not being available, without which their programme of work becomes abortive, while in the event of their time remaining not fully occupied owing to the absence of funds to procure material, specimens, chemicals, books, etc., the desire for economy may be carried too far, debarring, as it may, enthusiastic experts from showing their best work, while the Government on the other hand fails to derive full benefit from expenditure incurred on their salaries. It must be borne in mind that the actual expenditure of any one year is not a fair criterion of the expenditure called for in following years in the case of a young Institute the work of which must expand as it feels its way and gains the confidence of the Department and of the public. Funds should be allotted on a comparatively liberal scale to allow for this tendency, and it is submitted that the two officers controlling the Institute and intimately connected with the details of work and supervision, *i.e.*, the Inspector General of Forests and the President, may reasonably be expected to have carefully scrutinized all proposed expenditure and are in a favourable position to form a competent opinion as to whether such should be included in the budget estimates or not, and due weight should be accorded to their opinion. If funds are not

forthcoming or are unduly restricted, officers are liable to become disheartened, a period of stagnation ensues, and the usefulness of the Institute is not unlikely to become impaired possibly to the extent of endangering its successful working. It cannot be too fully realized that the tendency of research is towards expansion, and very rightly so, and that this expansion on well considered lines ought not to be hampered for want of the necessary funds.

It is difficult to say exactly what expenditure should have been correctly charged to the special grant of Rs. 20,000 for stores, equipment, etc., as the classification was elastic. During the year the Inspector General of Forests issued orders about this and from the 1st July 1910 a separate register is being kept up showing this expenditure as distinct and separate from the ordinary expenditure. In order to avoid possible confusion the President, Research Institute, keeps the money under the special grant under his own control and disburses it himself scrutinizing all bills sent to him to see whether they can be reasonably debited against this special grant or not.

CHAPTER IV.

The conduct of research work has at last been placed on a definite and satisfactory footing. Up till lately there were few distinct orders on the subject, it was impossible to know what assistance to expect from the Department, to what extent Research Institute officers had to carry out work themselves or to what extent they might expect aid from outside.

The scope of work has now been clearly defined. This was done by the creation of a Board of Forestry consisting of Conservators (or Chief Conservators) representing all the Provinces of India. This Board held its first meeting in April last under the presidency of the Inspector General of Forests. The Hon'ble Mr. Miller, Member in charge of the Revenue and Agriculture Department, and Mr. Carlyle, the Secretary of that Department, were also present—the former gave an excellent address on Research work and cognate subjects which has been printed and circulated throughout the Department. At this meeting, the proceedings of which are published separately and are in the hands of all Forest Officers, definite rules were laid down defining the general scope of each Research officer's work and the lines on which it should be conducted—a triennial programme of work was drawn up for each branch, while various subjects were discussed and resolutions passed on them. Among the most important were how the posts in the Research Institute should be filled, *i.e.*, whether by Forest Officers or experts from outside the Department. It was unanimously resolved that the only posts for which Forest Officers were necessary or advisable were those in the Sylviculture and Economic branches, that in other branches the appointment of experts outside the Department was in every way preferable. The President is in agreement with these views and trusts that as opportunity offers they may be given effect to. It was also resolved that a post of Forest Engineer be added to the cadre. This proposal is before the Government of India. Other subjects before the Board were how research work in the Provinces might best be co-ordinated with work carried out at the Institute, how far the time of Research Institute officers should be taken up in analysing samples of soils, that an agent in England was necessary to push the knowledge and sale of Forest Economic products, how best the formation and management of sample plots should be standardized, also tree measurements—the scope, necessity and size of Research Institute publications, etc.

The creation and meeting of the Board of Forestry is by far the most important, progressive and far-reaching step that has taken place since the formation of the Institute. Formerly its officers were in the dark, knowing little what was expected of them, and of what they might expect from the Department. The road has now been cleared for them. A secondary result of the meeting was that the representatives of the various Provinces are for the first time in touch with and aware of the aims and objects of the Institute and of its requirements, and they on seeing for themselves what is being done expressed every desire to co-operate; nor was this an empty expression of good-will; during the last few months specimens from all parts of India are being generously sent to Dehra and there seems to be a general feeling of sympathy with the objects and aims of the Institute, too often absent in the past. It was clearly brought out at the Board of Forestry meetings that purely academic research should be discouraged and that research should be confined as far as possible to objects of economic importance. This is as it should be.

Programme of work of the year.—This will be found in Appendix III. The progress made formed the subject of a return to the Inspector General of Forests in July last, while most of the more important items have been noticed in the body of the report.

Establishment.—As usual the Institute was short-handed—work was at times almost at a standstill for want of an adequate subordinate staff. This has since the close of the year been to a great extent rectified.

Buildings.—The position of affairs at the end of 1908-09 was an understanding that the Imperial Service officers were to be educated at any rate in part at the Institute.

that the Ranger classes were to leave Dehra. Acting on this assumption, and it was at that time more than an assumption, the President before his departure on leave advocated the building of the Institute close to the College buildings, which would not be required if the Ranger classes were to leave, and which would then have to be utilized as adjuncts to the new Institute building. On his return, however, other counsels were found to have prevailed and it appeared settled that the Ranger classes were to remain on. Under these altered circumstances, he agreed with the proposals put forward by Mr. Caccia that it was in every way preferable to acquire a separate site for the Institute, keeping this latter entirely apart from the College. Such a one has been found at Surajbagh close to Chandbagh and an area of some 16 acres taken up during the year at a cost of about Rs. 33,000. On this area will be erected the Institute and the subsidiary buildings, the plans of which are at present in the hands of the Public Works Department and have passed out of those of the President. It now rests with the Government of India to direct the Public Works Department to treat the case as urgent and to erect the buildings with the least possible delay.

The offices will on their completion be all located at Chandbagh, (where two offices now are), and at Surajbagh adjoining. The (Chandbagh) Botanist's office was improved during the year at a cost of some Rs. 800. At present accommodation is very short and there is much overcrowding—the end of this is however in sight.

Miscellaneous.—A valuable collection of photographs is being got together by Mr. Troup and there is a photographer attached to the Institute. Donations of such and of botanical specimens, etc., have been received from many officers, notably from Mr. Lace, the Chief Conservator of Forests, Burma, and are warmly acknowledged. The fact stands out clearly as noted above that many Forest Officers whose feelings towards the Institute were previously lukewarm now view its aims and objects very differently and the President takes this opportunity of thanking such for the specimens received and the services rendered by them. During the year Research Institute officers have often had to work under adverse conditions with much against them, they have however generally made the best of things and the President wishes to acknowledge this. These conditions are passing and research in the future may be looked forward to under happier auspices.

L. MERCER,
President, Imperial Forest Research Institute.

APPENDIX I.

List of all Forest Publications issued since the formation of the Imperial Forest Research Institute.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price.	Remarks.
		I.—Bulletins.			Rs. A P.	
1	Zoology Series	A note upon the Bee-Hole borer of teak in Burma.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Forest Bulletin No. 1.	..	Issued in 1905.
2	Do.	A note on the Quetta borer (*Aeolesthes sartus*).	Do. do.	Bulletin No. 2	..	Do.
3	Do.	A note on the Chilgoza (*Pinus Gerardiana*) bark-boring beetles of Zhob, Baluchistan.	Do. do.	Do. 3	..	Do.
4	Economy Series	*Ficus Elastica* : its natural growth and artificial propagation.	E. M. Coventry, I.F.S., Deputy Conservator of Forests.	Do. 4	..	Issued in 1906.
5	Zoology Series	Notes on a visit to some European Schools of Forestry.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Do. 5	..	Issued in 1905.
6	Economy Series	Memorandum on mechanical tests of some Indian timbers.	W. H. Everett, B.A., B.E., M.I.Mech.E., M.I.E.E., Professor of Mechanical and Electrical Engineering, Sibpur Engineering College.	Do. 6	..	Issued in 1906.
7	Zoology Series	Note on Chilgoza Forests of Zhob and the Takht-i-Suliman.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Do. 7	..	Do.
8	Do.	A note on the life history of *Hoplocerambyx Spinicornis* (the Singbhum Sal borer).	Do. do.	Do. 8	..	Do.
9	Sylvicultural Series.	Notes on the influence of forests on the storage and regulation of the water supply.	S. Eardley-Wilmot, I.F.S., C.I.E., Inspector General of Forests to the Government of India.	Do. 9	..	Do.
10	Zoology Series	A note on the Duki fig tree borer of Baluchistan (*Batocera rubus*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Do. 10	0 7 0	Do.
11	Do.	On some Assam Sal (*Shorea robusta*) insect pests.	Do. do.	Do. 11	1 10 0	Do.
		Note.—The Bulletin Series has been discontinued.				
		II.—Leaflets.				
1	Zoology Series	The Sal bark borer (*Sphærotrypes siwalikensis*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Leaflet No. 1	..	Issued in 1908.
2	Do.	The teak Defoliator (*Hyblœa puera*, Cram).	Do. do.	Do. 2	..	Do.
3	Do.	The Teak leaf skeletonisor (*Pyrausta Machœralis*, Wlk.).	Do. do.	Do. 3	..	Do.
4	Do.	*Scolytus major*	Do. do.	Do. 4	0 4 0	Issued in 1910.
5	Do.	*Polygraphus major*	Do. do.	Do. 5	0 3 0	Do.
		III.—Pamphlets.				
1	Chemistry Series.	Note on the Utilization of Khair forest in Eastern Bengal and Assam.	Puran Singh, F.C.S., Acting Forest Chemist.	Pamphlet No. 1	0 4 0	Issued in 1908.
2	Zoology Series	The bark-boring beetle attack in the coniferous forests in the Simla Catchment Area.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Do. 2	..	Do.
3	Working-Plan Series.	A Glossary of technical terms for use in Indian Forestry.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent, Forest Working-Plans.	Do. 3	0 4 0	Do.
4	Economy Series	Lac and Lac cultivation	D. N. Avasia, Extra Assistant Conservator of Forests.	Do. 4	0 2 0	Issued in 1909.
5	Sylvicultural Series.	Notes on Sal in Bengal	A. L. McIntire, I.F.S., Conservator of Forests, Bengal.	Do. 5	0 4 0	Do.
6	Do.	Forest Reservation in Burma in the interests of an endangered water-supply.	Alex. Rodger, I.F.S., Deputy Conservator of Forests.	Do. 6	1 0 0	Do.
7	Economy Series	Andaman marble wood or zebra-wood, *Diospyros Kurzii*, Heirn.	R. S. Troup, I.F.S., F.C.H., Imperial Forest Economist.	Do. 7	0 4 0	Do.

List of all Forest Publications issued since the formation of the Imperial Forest Research Institute—continued.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price.	Remarks.
					Rs. A. P.	
		III.—Pamphlets—*contd.*				
8	Sylvicultural Series.	The collection of statistical data relating to the principal Indian species.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Imperial Superintendent of Forest Working-Plans.	Pamphlet No. 8 .	0 10 0	Issued in 1910.
9	Working-Plan Series.	Note dealing with the progress made in Working-Plans.	Do. do. .	Do. 9 .	0 10 0	Do.
10	Economy Series	Note on Burmese *Leza* Wood.	R. S. Troup . . .	Pamphlet No. 10, Economy Series No. 3.	0 2 0	
11	Do. .	Note on Carallia Wood .	Do.	Pamphlet No. 11, Economy Series No. 4.	0 2 0	
12	Do. .	Petwun or Trincomali Wood.	Do.	Pamphlet No. 12, Economy Series No. 5.	0 4 0	
13	Do. .	Burmese *In* Wood . .	Do.	Pamphlet No. 13, Economy Series No. 6.	1 0 0	
14	Do. .	Burma Padauk . .	Do.	Pamphlet No. 14, Economy Series No. 7.	1 0 0	
15	Botany Series	Note on Best Season for Coppice Fellings of Teak.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S.	Pamphlet No. 16, Botany Series No. 1.	0 4 0	
		IV.—Records.				
1	Zoology Series	A note on the lac insect (*Tachardia lacca*), its life history, propagation and collection.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Record, Vol. I, Part I.	1 4 0	Issued in 1908.
2	Working-Plan Series.	A preliminary note on the development of the Sal in volume and in money value.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Imperial Superintendent of Forest Working-Plans.	Record, Vol. I, Part II.	1 0 0	Do.
3	Economy Series	*Pterocarpus dalbergioides*, Roxb., Andamans padauk.	B. B. Osmaston, I.F.S., Conservator of Forests, United Provinces.	Record, Vol. I, Part III.	1 4 0	Do.
4	Zoology Series	A further note on the Chilgoza bark-boring beetles of Zhob.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.			
5	Economy Series	A note on the present position and future prospects of the Cutch trade in Burma.	R. S. Troup, I.F.S., F.C.H., Imperial Forest Economist.			
6	Chemistry Series.	Note on the manufacture of Ngai camphor.	Puran Singh, F.C.S., Acting Forest Chemist.			
7	Do. .	A chemical investigation of the constituents of Burmese varnish (*Melanorrhœa usitata* sap).	Do. do. .	Record, Vol. I, Part IV.	1 4 0	Issued in 1909.
8	Working-Plan Series.	The selection system in Indian forests as exemplified in working-plans based on this system with a short description of some Continental methods.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Imperial Superintendent of Forest Working-Plans.			
9	Zoology Series	Note on some insect pests of the Himalayan oaks.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Record, Vol. II, Part I.	0 6 0	Do.
10	Economy Series	Note on fissibility of some Indian woods.	R. S. Troup, I.F.S., F.C.H., Imperial Forest Economist.	Record, Vol. II, Part II.	1 6 0	Issued in 1910.
		V.—Memoirs.				
1	Zoology Series	On some undescribed Scolytidæ of economic importance from the Indian Region, I.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Memoir, Vol. I, Part I.	1 4 0	Issued in 1908.
2	Do. .	Second monograph on some undescribed Scolytidæ of economic importance from the Indian Region, II.	Do. do. .	Memoir, Vol. I, Part II.	0 4 0	Issued in November 1909.
	Botanical Series.	*Nil.*				

List of all Forest Publications issued since the formation of the Imperial Forest Research Institute—concluded.

Serial No.	Branch of Research.	Name of Publications.	Author.	Form in which issued.	Price.	Remarks.
		V.—Memoirs—*contd.*			Rs. A. P.	
4	Chemistry Series.	A note on the analysis of Cutch and the preparation of pure Catechin.	Puran Singh, F.C.S., Acting Forest Chemist.	Memoir, Vol. I, Part I.	1 4 0	Issued in 1908.
5	Do. .	A note on the manufacture of pure shellac.	Do. do. .	Memoir, Vol. I, Part II.	0 8 0	Issued in 1909.
	Sylvicultural Series.	*Nil.*				
6	Economy Series	Indian woods and their uses.	R. S. Troup, I.F.S., F.C.H., Imperial Forest Economist.	Memoir, Vol. I, Part I.	2 12 0	Issued in 1908.
7	Do. .	Note on the prospects of match industry.	Do. do. .	Memoir, Vol. I, Part II.	1 12 0	Issued in May 1910.
	Working-Plan Series.	*Nil.*				
		VI.—Manuals.				
1	Economy Series	Manual of Utilization .	R. S. Troup, I.F.S., F.C.H., Imperial Forest Economist.	Manual . .	2 4 0	Issued in 1907.
2	Zoology Series	Manual of Forest Zoology.	E. P. Stebbing, I.S.F., F.L.S., F.Z.S., F.E.S., Imperial Forest Zoologist.	Do. . .	10 0 0	Issued in 1908.
3	Botany Series	Manual of Forest Botany .	R. S. Hole, I.F.S., F.C.H., F.L.S., F.E.S., Imperial Forest Botanist.	Do. . .	*3 8 0	Issued in 1909.
4	Working-Plan Series.	Revised fourth edition of D'Arcy's preparation of Forest Working-Plans.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Imperial Superintendent of Forest Working-Plans.		0 14 0	Issued in July 1910.

* Bound volume.

APPENDIX II.

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1909-10.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
4th December 1909	Conservator of Forests, Pretoria, Transvaal.	Imperial Forest Botanist.	Pinus Gerardiana	Seed	9 lbs.	
14th January 1910	Political Agent in Zhob, Fort Sandeman.	Ditto	Diospyros Lotus	Do.	2 „	
27th May 1910	Johannes Rafn, Esq., Copenhagen.	Ditto	Pinus longifolia	Do.	10 „	
Ditto	Ditto	Ditto	Ditto	Cones	6 in No.	
9th April 1910	Chief Conservator of Forests, Nairobi.	Ditto	Abies Pindrow	Seed	5 lbs.	
18th March 1910	Mons. L. A. Dodé, 4 place du Maine, Paris 15°, France.	Ditto	Salix acmophylla	Cuttings	„	
22nd March 1910	Ditto	Ditto	Salix tetrasperma	Do.	„	
23rd March 1910	Chief Conservator of Forests, British East Africa Protectorate.	Ditto	Cupressus torulosa	Seeds	5 lbs.	
			Cupressus macrocarpa	Do.	5 „	
30th June 1910	Deputy Conservator of Forests, Nairobi.	Ditto	Cedrela Toona	Do.	10 „	
13th July 1910	Director of Forestry, Manila, Philippine Islands.	Ditto	Pinus longifolia	Do.	5 „	
2nd July 1910	Mons. L. A. Dodé, 4 place du Maine, Paris 15°, France.	Ditto	Populus ciliata	„	„	
			Salix Wallichiana	Cuttings	12 of each.	
			Salix elegans	„	„	
22nd July 1909	Consul General for Portugal, Bombay.	Ditto	Bombax malabaricum	Seeds	2 lbs.	
Ditto	Ditto	Ditto	Butea frondosa	Do.	8 „	
Ditto	Ditto	Ditto	Populus euphratica	Do.	12 „	
23rd September 1909	Ditto	Ditto	Acacia arabica	Do.	8 „	
23rd September 1909 and 18th January 1910.	Ditto	Ditto	Grewia tiliæfolia	Do.	22½ „	
17th March 1910	Ditto	Ditto	Acacia Catechu	Do.	18¼ „	
30th June 1910	Ditto	Ditto	Dendrocalamus strictus.	Do.	½ „	
11th Novemner 1909	Ditto	Ditto	Grewia vestita	Do.	8 „	
23rd September 1909	Ditto	Ditto	Cordia Myxa	Do.	7½ „	
16th June 1910	Ditto	Ditto	Cordia Macleodii	Do.	10 „	
18th January 1910	Ditto	Ditto	Anogeissus pendula.	Do.	10½ „	
23rd September 1909	Ditto	Ditto	Dalbergia Sissoo	Do.	6 „	
			Santalum album	Do.	9 „	
			Zizyphus Jujuba	Do.	10 „	
			Albizzia amara	Do.	10 „	
11th November 1909	Ditto	Ditto	Tamarix dioica	Do.	13 „	
17th July 1909 and 23rd September 1909.	Conservator of Forests, Southern Nigeria	Ditto	Cedrela Toona	Do.	20 „	
17th July 1910	Ditto	Ditto	Pinus Merkusii	Do.	8 „ 14 oz.	
23rd September 1909	Ditto	Ditto	Xylia dolabriformis.	Do.	18 „	
	Ditto	Ditto	Chloroxylon Swietenia.	Do.	7 „	
13th January 1910.	Chief Conservator of Forests, British East Africa.	Ditto	Dalbergia Sissoo	Do.	20 „	
7th July 1909	Director of Forests and Gardens, Port Louis, Mauritius.	Ditto	Pinus longifolia	Do.	25 „	
18th December 1909	Mons. R. Hickel, Versailles, France.	Ditto	Acer Caesium	Do.	15¾ „	
			Acer caudatum	Do.	10½ „	
			Acer pictum	Do.	2¾ „	
24th July 1909	Botanist, Department of the Interior, Bureau of Science, Manila.	Imperial Forest Economist.	Three different species	Small wood specimens.	38 in No.	
27th December 1909	Professor Percy Groom, Royal College of Science, South Kensington, London.	Ditto	Sixty-eight different species	Do.	68 „	
20th January 1910.	Mr. H. J. Elves, F.R.S., Chettenham, England.	Ditto	(1) Sterospermum Xylocarpum. (2) Carallia integerima. (3) Dalbergia Oliveri (4) Albizzia amara. (5) Pterocarpus marsupium.	Wood specimens.	5 „	
16th February 1910.	Professor Percy Groom, Royal College of Science, South Kensington, London.	Ditto	(1) Quercus glauca (2) Quercus lamellosa (3) Quercus spicata.	Do.	3 „	

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1909-10—continued.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
26th February 1910	M. de Plason de Waestyne, Conseiller du Ministère des Affaires Etrangrèes, Vienna, Austria.	Conservator of Forests, Bengal.	Larix Griffithii .	Seeds .	2 lbs.	
16th April 1910 .	Reporter on Economic Products to the Government of India, Calcutta.	Imperial Forest Economist.	(1) Sterculia villosa. (2) Randia dumetorum. (3) Strychnos potatrum.	(1) Gum and fibre. (2) Fruit . (3) Seed .	Small quantities for Museum.	

APPENDIX III.

Revised Programme of work of the Imperial Forest Research Institute for 1909-10.

The following are some of the various investigations which will be made by officers of the Imperial Forest Research Institute, Dehra Dun, with the assistance of other officers of the Department:—

I.—Working-Plans.

1. The compilation from selected Working-Plans of data regarding the rate of growth of different species (ring countings, sample plots) and generally the tabulating, in convenient form, of statistics and information regarding different species, methods of working, etc., now scattered throughout the plans. A statement showing sanctioned Working-Plans, with area of forest, period of plan, method of treatment and principal species has already been compiled as a basis of this and other investigations.

2. With regard to normal stock, selected areas containing what appears to be a full stock of I, II, III and other classes will be counted out, and the average of each class taken as an approximate normal, as a preliminary to the more accurate investigation of this subject. The following species will be first taken in hand—Sal, Teak, Deodar, *Pinus longifolia, Pinus excelsa,* and other species now being worked under Working-Plans as soon as possible.

3. A careful study of the selection system will be made. The following points merit attention in this regard in order to discover the best means of working by compartments so as most nearly to approach the ideal method of working over the entire area annually for the removal of mature trees, *e.g.*—

(*i*) By making the annual coupes as large as possible so that the area may be worked over at as frequent intervals as possible.
(*ii*) By fixing such an exploitable girth that the loss of interest due to leaving mature trees standing for an excessive period is reduced.
(*iii*) By allotting gradually decreasing areas for the annual coupes.

4. The examination of control forms in order to ascertain the average outturn by different methods of working in force, and generally to collect and collate the statistics of the results of forest management throughout India which are included in past control forms will be continued.

5. Preparation for teak of a paper setting forth all that is known regarding habits, methods of treatment, etc., such as has already been prepared for the sâl.

6. Preparation of yield tables (as far as data are available) for:—

(*i*) *Sissoo* plantations at Changa-Manga.
(*ii*) *Eucalyptus* plantation at Ootacamund.
(*iii*) *Casuarina* plantations in Madras.
(*iv*) Teak plantations at Nilambur.

7. Preparation of tables of outturn for:—

(*i*) Some selected high forests in the United Provinces (or elsewhere) under the selection system, in which enumerations have been carried out.
(*ii*) Some selected sâl coppice forests in the United Provinces.
(*iii*) Teak forests in Burma.

8. Preparation of a note on the application of the *uniform method* with special reference to India and with examples from Indian working-plans.

9. Upkeep of Registers of sample plots and publication of any data available.

10. Opening of Ledger files relating to definite subjects under investigation or to be hereafter brought under investigation.

II.—Sylviculture.

11. Study of the effects of fire conservancy on different species in various conditions of climate and growth, more especially on sâl and teak, will be continued.

12. An examination into the conditions favourable to the replacement of the selection method by the regular method will be continued.

13. Investigation into the effects of soil composition and underlying rock on the distribution and growth of different species will be continued.

14. Enquiry into the effects of the continuance of a given species (*e.g.*, sâl, teak) as regards the soil fertility for that species will be continued.

15. Collection of information regarding plantation work carried out on a large scale, specially Agri-sylvicultural operations and the planting of arid lands and shifting sands; and the publication of pamphlets dealing with these subjects.

16. The study of teak reproduction in conjunction with the Imperial Forest Botanist and the Imperial Forest Chemist.

17. The study of sâl reproduction in conjunction with the Imperial Forest Botanist and Imperial Forest Chemist.

18. Putting in order the Kaunli garden for sylvicultural research purposes in conjunction with the Imperial Forest Botanist.

19. Subjects to be investigated on the initiation of Conservators by them in conjunction and in correspondence with the Sylvicultural branch of the Research Institute.

III.—Forest Zoology.

20. Investigation (in the United Provinces) into the distribution and life histories of the *Monophlebus* scale insect, *Spœrotrypes siwalikensis*, and the sâl defoliators in the sub-montane sâl areas of the Ganges, Garhwal, Kumaun and Naini Tal divisions and into the Pinus longifolia *Cryptorrhynchid* weevil, *Tomicus* and *Polygraphus* bark-borers and *Platypus* wood-borer in the *chir* areas of Garhwal, Kumaun and Naini Tal divisions will be continued.

21. Investigation (in the Punjab) into the distribution and life histories of the following insects in the hill coniferous forests of the Kangra Division:—

The *Scolytus* pests of the deodar and the *Polygraphus*, *Pityogenes*, *Platypodæ* and cone-borers and defoliators of the Pinus excelsa, Spruce and Silver fir; also the defoliating and wood-boring pests of the hill oaks and pests of Pinus longifolia will be continued.

22. Investigation into the autumn generations of the life histories of the insect pests of Deodar, Silver fir, Spruce, Blue Pine, and Pinus longifolia will be continued.

23. Investigation into the insect pests of the sâl tree in Oudh.

24. Investigation into the life history of the *Padauk* weevil pest and the *Padauk Scolytid* wood-borer.

25. Investigation into an important *Scolytid* wood-borer of the "sundri," a defoliating pest of this tree and other pests of the mangrove forests.

(26) Boring molluscs of bamboos in tidal waters in Burma.

27. Destruction of babul plantations in Berar by rats and a longicorn beetle.

28. Predaceous and parasitic pests of the lac insect.

IV.—Forest Economy.

29. The enquiry into the utilization of the less valuable kinds of timber as railway sleepers will be continued and a practical experiment is being made with sleepers obtained from Dipterocarpus sp. from Burma and the Andamans.

30. Enquiry will continue into the subject of:—

(*a*) Woods suitable for the manufacture of matches.

(*b*) Cultivation of lac.

(*c*) Antiseptic treatment of timber, particularly for railway sleepers.

(*d*) Utilization of various oil-seeds from forest trees.

(*e*) Utilization of *Xylia dolabriformis* waste for paving blocks.

(*f*) Woods likely to be useful for minor industries.

(*g*) Woods for tea boxes.

(*h*) Camphor (Lævo Borneol) from *Blumea balsamifera*.

(*i*) Cultivation of *Podophyllum Emodi*.

(*j*) Cutch.

(*k*) Destructive distillation of wood in conjunction with the Imperial Forest Chemist.

31. Investigations will be made into the following subjects:—

(*a*) Actual process and prospects of the manufacture of matches as a commercial enterprise. Best sites for the establishment of match factories and available supply of timber suitable for the manufacture of matches.

(*b*) Wood-pulp industry.

(*c*) Wood suitable for the manufacture of casks, packing cases and opium chests.

(*d*) Powellizing inferior woods.

(*e*) Padauk wood from the Andamans. Cause of falling off in demand, and possible measures for stimulating it.

(*f*) Investigation into the physical properties and seasoning powers of various woods.

(*g*) Utilization of gum resins.

V.—Forest Botany.

32. Enquiry into the following subjects will continue:—

(*a*) Study of the coppicing of teak, its effect on the normal health and development of the tree.

(*b*) The grasses of the Savannah tracts in Bengal will be examined with special reference to their difference in burnt and unburnt areas.

(*c*) A practical examination will be made into the effects of fire on grazing areas in order to ascertain:—

(*i*) Whether the grass on areas burned over annually decreases in quantity or quality;

(*ii*) Whether this result or the reverse happens in the case of areas protected from fire; and specially whether protection from fire encourages the growth of coarser grasses, or leads to the replacement of coarse grasses by others more suitable for fodder.

(*d*) A study will be made of the timber of different species of *tun* and *Grewia* to ascertain which yield the most valuable wood.

(*e*) Investigation (in the Madras Presidency) into the subject of the rising of marks on tree stems, used to indicate fixed levels of measurement in sample trees or plots.

33. The following subjects will receive attention:—

(*a*) Study of Teak reproduction.

(*b*) Study of Sal reproduction.

(*c*) Rearrangement and putting in order of Saharanpur Herbarium (located at Dehra Dun).

(*d*) Putting in order the Kaunli garden for research purposes in conjunction with the Sylviculturist.

VI.—Forest Chemistry.

34. Further examination of tannin extracts will be made, especially the tannin extracted from mangrove at the Rangoon works, with a view to its decolorization.

35. The collection and analysis of the lattices of rubber producing species will be continued.

36. The following subjects will continue to be worked at:—

(*a*) The estimation of the amount of oil from seeds of forest trees and the utilization of the cake.

(*b*) Experiments with the newly designed camphor still and the distillation of camphor from *Blumea balsamifera* of Burma.

(*c*) Investigation (in Burma) into the various species of Compositæ as to their suitability for the production of camphor or any other valuable essential oil.

(*d*) Investigation into Catechu with a view to prepare Catechin-free Cutch on a commercial scale will be continued.

(*e*) Investigation into the manurial value of the various leaves, twigs and shrubs indigenous in the Madras Presidency, in order to ascertain the proportion of nitrogen and phosphoric acid, etc., which they contain.

37. Enquiry will be made into the following subjects:—

(*a*) The effect of differences of soil on production of the resin in *Podophyllum Emodi*.

(*b*) Investigation into the destructive distillation of wood in conjunction with the Imperial Forest Economist.

(*c*) The improvement of the process of distillation of Rusa grass oils.

(*d*) Calorific power of different Indian timbers.

VII.—General.

38. Pamphlets, circulars, as well as the Memoirs and Records of the Forest Department, setting forth the results of investigations into various subjects affecting the progress of Indian Forestry, will be published from time to time.

APPENDIX IV.

ANNUAL FORM No. 67.

FOREST DEPARTMENT, INDIA.

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1909-10.

BUDGET HEADS. REVENUE.	President.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	Total.
	2	3	4	5	6	7	8
I.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY GOVERNMENT AGENCY—							
a. Timber	..	..	..	..	..	..	..
b. Firewood and charcoal	..	..	..	..	..	..	..
c. Bamboos	..	..	..	..	..	..	..
d. Sandal-wood	..	..	..	..	..	..	..
e. Grass and other minor produce	..	..	..	..	..	..	..
TOTAL I	..	..	..	..	..	..	..
II.—TIMBER AND OTHER PRODUCE REMOVED FROM THE FORESTS BY CONSUMERS OR PURCHASERS—							
a. Timber	..	..	..	..	..	..	..
b. Firewood and charcoal	..	..	..	..	..	..	..
c. Bamboos	..	..	..	..	..	..	..
d. Grazing and fodder grass	..	..	..	..	..	..	..
e. Other minor produce	..	..	..	..	..	..	..
f. Forest stamps	..	..	..	..	..	..	..
g. Other items	..	..	..	..	..	..	..
h. Commutation fees	..	..	..	..	..	..	..
TOTAL II	..	..	..	..	..	..	..
III.—DRIFT AND WAIF WOOD AND CONFISCATED FOREST PRODUCE	..	..	..	..	..	..	..
TOTAL III	..	..	..	..	..	..	..
IV.—REVENUE FROM FORESTS NOT MANAGED BY GOVERNMENT—							
a. Duty on foreign timber and other forest produce	..	..	..	..	..	..	..
b. Revenue from shared and private forests	..	..	..	..	..	..	..
TOTAL IV	..	..	..	..	..	..	..
V.—MISCELLANEOUS—							
a. Fines and forfeitures	..	..	..	..	..	..	..
b. Refunds	..	..	1	21	629	116	767
c. Other sources	..	..	..	..	..	25	25
TOTAL V	..	..	1	21	629	141	792
GRAND TOTAL REVENUE	..	..	1	21	629	141	792

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1909-10—continued.

Budget Heads. Expenditure.	President.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	Total.
1	2	3	4	5	6	7	8
A.—Conservancy and Works.							
I.—Timber and other produce removed from the forests by Government Agency—							
a. Timber	..	..	..	..	..	..	..
b. Firewood and charcoal	..	..	..	..	..	..	..
c. Bamboos	..	..	..	..	..	..	..
d. Sandal-wood	..	..	..	..	..	..	..
e. Grass and other minor produce	..	..	..	..	..	..	..
Total AI	..	..	..	..	..	..	..
II.—Timber and other produce removed from the forests by consumers or purchasers	..	..	..	..	..	..	..
Total AII	..	..	..	..	..	..	..
III.—Drift and waif wood and confiscated forest produce	..	..	..	..	..	..	..
Total AIII	..	..	..	..	..	..	..
IV.—Revenue from forests not managed by Government—							
a. Duty on foreign timber and other forest produce	..	..	..	..	..	..	..
b. Revenue from shared and private forests	..	..	..	..	..	..	..
Total AIV	..	..	..	..	..	..	..
V.—Rent of leased forests and payments to share-holders in forests managed by Government	..	..	..	..	..	..	..
Total AV	..	..	..	..	..	..	..
VI.—Live Stock, Stores, Tools and Plant—							
a. Purchase of cattle	..	..	..	..	..	..	..
b. Feed and keep of cattle	..	..	..	..	..	..	..
c. Purchase of stores, tools and plant	5,327	1,082	409	1,642	1,551	2,373	12,384
Total AVI	5,327	1,082	409	1,642	1,551	2,373	12,384
VII.—Communications and Buildings—							
a. Roads and Bridges	508	..	..	..	..	..	508
b. Buildings	..	..	..	..	..	..	..
c. Other works	..	..	141	3	..	..	144
Total AVII	508	..	141	3	..	..	652
VIII.—Organization, Improvement and Extension of Forests—							
a. Demarcation	..	..	..	..	..	..	..
b. Cost of Forest Settlements; Compensation for land and rights	..	..	..	..	..	..	..
c. Surveys	..	..	..	..	..	..	..
d. Working-plans	..	..	..	..	..	..	..
e. Sowing and planting	..	..	..	..	..	..	..
f. Protection from fire	..	..	..	..	..	..	..
g. Other works	..	..	..	..	..	..	..
Total AVIII	..	..	..	..	..	..	..
IX.—Miscellaneous—							
a. Law charges	..	..	..	..	..	..	..
b. Other charges	643	499	938	191	1,282	3,520	7,073
Total AIX	643	499	938	191	1,282	3,520	7,073
Carried over Total A.—Conservancy and Works	6,478	1,581	1,488	1,836	2,833	5,893	20,109

Summary of Revenue and Expenditure of the Imperial Forest Research Institute for the Forest year 1909-10—concluded.

Budget Heads. Revenue.	President.	Superintendent, Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	Total.
1	2	3	4	5	6	7	8
Brought over Total A.—Conservancy and Works	6,478	1,581	1,488	1,836	2,833	5,893	20,109
B.—Establishments.							
I.—Salaries—							
a. Conservators . . .	..	..	..	..	..	..	..
b. Superior Officers . . .	..	10,500	10,055	7,500	9,900	12,058	50,013
c. Subordinate forest and depôt establishments	..	..	..	..	..	..	..
d. Office establishments . .	4,967	2,382	3,525	2,622	1,931	1,667	17,094
e. Deputation and special allowances	..	1,800	1,875	1,350	1,800	1,089	7,914
f. Exchange compensation allowance	..	..	..	..	..	..	..
Total BI .	4,967	14,682	15,455	11,472	13,631	14,814	75,021
II.—Travelling Allowances—							
a. Conservators . . .	..	..	..	..	..	..	..
b. Superior Officers . . .	..	1,412	407	1,982	1,852	2,082	7,735
c. Subordinate forest and depôt establishments	..	..	..	..	..	..	..
d. Office establishments . .	25	317	72	861	589	647	2,511
Total BII .	25	1,729	479	2,843	2,441	2,729	10,246
III.—Contingencies—							
a. Stationery	44	1	38	33	16	34	166
b. Carriage of tents and records .	11	459	11	158	433	65	1,137
c. Rents, rates and taxes . .	..	..	1,862	240	..	58	2,160
d. Pay of police-guards . . .	..	..	..	..	..	..	..
e. Official postage . . .	122	235	160	225	402	201	1,345
f. Sundries	5,026	522	1,713	426	818	940	9,445
Compensation for dearness of provisions	..	..	..	..	..	..	..
Total BIII .	5,203	1,217	3,784	1,082	1,669	1,298	14,253
Total B.—Establishments .	10,195	17,628	19,718	15,397	17,741	18,841	99,520
Add Total A.—Conservancy and Works	6,478	1,581	1,488	1,836	2,833	5,893	20,109
GRAND TOTAL OF ALL EXPENDITURE	16,673	19,209	21,206	17,233	20,574	24,734	1,19,629
Surplus or Deficit .	—16,673	—19,209	—21,205	—17,212	—19,945	—24,593	—1,18,837

P. N. MUKHERJI,
Chief Superintendent,
Office of the Comptroller, India Treasuries.

Calcutta ;
The 23rd August 1910.

APPENDIX V.

FORM No. 68.—[*Prescribed.*]

FOREST DEPARTMENT, INDIA.

Account Current of the Imperial Forest Research Institute for Forest year 1909-10.

RECEIPTS.

——	President.	Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	A. P.
Cash Balance	32 4 0	54 1 0	..	..	1 8 0	..	87 13 0
VIII.—Assessed Taxes—							
Income Tax—Deductions from salaries	74 4 4	255 4 2	278 14 6	209 11 2	278 14 6	318 5 4	1,415 6 0
Revenue during the Forest year 1909-10	..	..	1 0 0	21 1 7	628 12 10	140 14 0	791 12 5
Forest Advances	1,043 15 8	1,744 9 2	3,920 7 3	3,123 0 9	2,780 13 0	6,913 13 10	19,526 11 8
Suspense Account	..	..	..	..	3 0 0	186 5 0	189 5 0
Forest Deposits	..	..	..	..	..	..	..
Service Funds—							
Uncovenanted Service Family Pension Fund, Bengal	..	..	357 8 0	..	..	..	357 8 0
Savings Bank Deposits—							
Bank Account—							
Forest Officers' Provident Fund	..	1,050 0 0	180 0 0	630 0 0	990 0 0	720 0 0	3,570 0 0
General Provident Fund	..	..	437 3 0	100 0 0	..	..	537 3 0
Cash Remittances—Local—Forest Remittances—							
Forest cheques drawn	458 9 1	4 14 6	553 14 6	257 5 3	27 2 3	248 10 3	1,550 7 10
Revenue Remittances written back	..	..	..	..	..	..	..
Inter-divisional Transfers	..	..	..	..	..	..	..
Exchange Account with other Governments—							
Account between India and Central Provinces—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Central Provinces	..	..	..	..	..	..	..
Account between India and Burma—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Burma	..	..	..	..	..	..	..
Account between India and Eastern Bengal and Assam—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Eastern Bengal and Assam	..	..	..	..	..	..	..
Account between India and Bengal—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Bengal	..	..	..	..	..	..	..
Account between India and United Provinces of Agra and Oudh—							
III.—Items adjustable by India	18,094 14 8	17,369 0 5	19,163 5 0	16,489 4 7	18,740 2 0	23,590 3 2	1,08,446 13 10
IV.—Items adjustable by United Provinces of Agra and Oudh	..	..	..	..	..	..	..
Account between India and Punjab—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Punjab	..	..	..	..	..	..	..
Account between India and Madras—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Madras			..	..	..	..	..
Account between India and Bombay—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Bombay	..	..	..	..	600 0 0	..	600 0 0
Inter-Departmental Transfers—							
Public Works Department, Ordinary Branches	..	..	..	..	..	..	..
Public Works Department, Railway Branch	..	..	..	..	..	..	..
Military Supply Department	14 8 9	16 4 10	104 0 0	50 7 9	70 10 0	164 9 0	420 8 4
" " " Northern Circle	..	..	..	..	..	..	..
" " " Western Circle	..	..	..	..	..	..	..
Telegraph Department	..	..	..	..	..	..	..
Post Office Department	..	..	..	..	..	..	..
Civil Departments	113 8 0	..	31 8 0	20 11 0	..	..	165 11 0
Marine Department	2,890 13 6	633 13 9	51 0 0	12 0 0	96 12 0	47 2 0	3,731 9 3
GRAND TOTAL	17,722 14 0	21,127 15 10	25,078 12 3	20,913 10 1	24,217 10 7	32,329 14 7	1,41,390 13 4

Account Current of the Imperial Forest Research Institute for Forest year 1909-10—continued.

PAYMENTS.

——	President.	Working-Plans.	Botanist.	Zoologist.	Economist.	Chemist.	TOTAL.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
I.—Refunds and Drawbacks—							
Expenditure during the Forest year 1909-10	16,672 11 3	19,208 10 3	21,205 15 0	17,232 11 10	20,573 9 2	24,734 3 7	1,19,627 13 1
Forest Deposits	..	..	..	..	..	..	..
Forest Advances	1,050 2 9	1,818 10 7	3,871 13 3	2,818 5 4	2,412 4 7	7,268 8 0	19,239 12 6
Suspense Account	..	..	..	..	..	186 5 0	186 5 0
Savings Bank Deposits—							
Bank Account—							
Forest Officers' Provident Fund	..	..	..	..	..	..	..
General Provident Fund	..	..	..	400 0 0	..	..	400 0 0
Cash Remittances—Local—Forest Remittances—							
Remittances to Treasuries	..	..	..	..	628 12 10	..	628 12 10
Unpaid cheques written back	..	..	..	..	..	..	..
Inter-divisional Transfers	..	..	..	..	..	..	..
Account Current with Foreign States—							
Her Majesty's Colonial Government, Ceylon	..	..	..	..	..	..	..
Exchange Account with other Governments—							
Account between India and Central Provinces—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Central Provinces	..	..	..	..	..	..	..
Account between India and Burma—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Burma	..	..	..	..	..	..	..
Account between India and Eastern Bengal and Assam—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Eastern Bengal and Assam	..	..	..	..	..	..	..
Account between India and Bengal—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Bengal	..	..	..	..	..	..	..
Account between India and United Provinces of Agra and Oudh—							
III.—Items adjustable by India	..	100 11 0	1 0 0	21 1 7	3 0 0	140 14 0	266 10 7
IV.—Items adjustable by United Provinces of Agra and Oudh	..	..	..	..	..	..	..
Account between India and Punjab—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Punjab	..	..	..	..	..	..	..
Account between India and Madras—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Madras	..	..	..	..	..	..	..
Account between India and Bombay—							
III.—Items adjustable by India	..	..	..	..	..	..	..
IV.—Items adjustable by Bombay	..	..	..	..	600 0 0	..	600 0 0
Inter-Departmental Transfers—							
Public Works Department, Ordinary Branches	..	..	..	..	..	..	..
Public Works Department, Railway Branch	..	..	..	..	..	..	..
Military Department, Eastern Circle	..	..	..	..	..	..	..
Military Department, Northern Circle	..	..	..	..	..	..	..
Military Department, Western Circle	..	..	..	..	..	..	..
Military Department, Secunderabad Circle	..	..	..	..	..	..	..
Telegraph Department	..	..	..	..	..	..	..
Post Office Department	..	..	..	..	..	..	..
Marine Department	..	..	..	..	..	..	..
Civil Departments	..	..	..	..	..	..	..
Cash Balance	..	..	..	441 7 4	..	..	441 7 4
GRAND TOTAL	17,722 14 0	21,127 15 10	25,078 12 3	20,913 10 1	24,217 10 7	32,329 14 7	1,41,390 13 4

P. N. MUKHERJI,
Chief Superintendent,
Office of the Comptroller, India Treasuries

CALCUTTA;
The 23rd August 1910.

APPENDIX VI.

ANNUAL FORM NO. 70.—[*Prescribed.*]

FOREST DEPARTMENT, INDIA.

Outstandings and Liabilities on account of Contractors and Disbursers for Forest year 1909-10.

Division.	DEPARTMENT DEBTOR.			DEPARTMENT CREDITOR.			BALANCE DUE.		REMARKS.
	Opening balance.	Recoveries in cash and value of supplies and work done during the year.	Total.	Opening balance.	Payments made during year.	Total.	To Department (Outstandings).	By Department (Liabilities).	
1	2	3	4	5	6	7	8	9	10
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
President, Imperial Forest Research Institute	..	1,043 15 8	1,043 15 8	2 1 10	1,050 2 9	1,052 4 7	8 4 11	..	
Superintendent of Working-Plans	..	1,744 9 2	1,744 9 2	12 2 9	1,818 10 7	1,830 13 4	86 4 2	..	
Forest Botanist		3,920 7 3	3,920 7 3	84 15 5	3,871 13 3	3,956 12 8	36 5 5	..	
Forest Zoologist	..	3,123 0 9	3,123 0 9	311 11 5	2,818 5 4	3,130 0 9	7 0 0	..	
Forest Economist	..	2,780 13 0	2,780 13 0	411 6 6	2,412 4 7	2,823 11 1	42 14 1	..	
Forest Chemist	..	6,913 13 10	6,913 13 10	384 12 6	7,268 8 0	7,653 4 6	739 6 8	..	
TOTAL	..	19,526 11 8	19,526 11 8	1,207 2 5	19,239 12 6	20,446 14 11	920 3 3	..	

P. N. MUKHERJI,
Chief Superintendent,
Office of the Comptroller, India Treasuries.

CALCUTTA ;
The 23rd August 1910.

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
8, HASTINGS STREET

2

PROGRESS REPORT

OF THE

FOREST RESEARCH INSTITUTE

FOR

1911-1912

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1912

[PRESCRIBED MAXIMUM LIMIT OF REPORT—10 PAGES.]

Progress Report of the Forest Research Institute for the Forest Year 1911-12.

CHAPTER I.

ADMINISTRATION.

The writer of the Report again held the post of President throughout the year.

The names of the Officers who held charge of the various branches are given in the table below :—

Branch of the Forest Research Institute.	Dates. From	Dates. To	Name of Officer in charge.
Sylviculture . .	1st July 1911 .	30th June 1912 .	Mr. R. S. Troup, F.C.H., Deputy Conservator of Forests.
Forest Botany .	1st July 1911 .	30th June 1912 .	Mr. R. S. Hole, F.C.H., F.L.S., F.E.S., Deputy Conservator of Forests.
Forest Economy .	1st July 1911 .	28th November 1911	Mr. A. Rodger, Deputy Conservator of Forests.
	29th November 1911	30th June 1912 .	Mr. R. S. Pearson, Deputy Conservator of Forests.
Forest Zoology .	1st July 1911 .	29th October 1911 .	Mr. R. S. Hole, F.C.H., F.L.S., F.E.S., Deputy Conservator of Forests.
	30th October 1911 .	30th June 1912 .	Dr. A. D. Imms, B.A., B.Sc., D.Sc.
Forest Chemistry .	1st July 1911 .	30th June 1912 .	Mr. Puran Singh, F.C.S.

CHAPTER II.

SECTION 1.—THE WORK OF THE INSTITUTE.

The various Officers (except the Zoologist) delivered a series of lectures during the rains session of the College in their respective subjects to the third year students.

The work of the Institute is now proceeding smoothly on well regulated lines, but it is evident that owing to the detailed nature of the investigations and to the annually increasing number of references made by Officers of the Department, firms and private individuals, assistance must be afforded at least in some of the branches.

SECTION 2.—INVESTIGATIONS AND RESEARCH IN THE VARIOUS BRANCHES.

(a) Working Plans and Sylviculture.

The work of the year may be summarised as follows :—

Two sample plots in the Siwalik and Kheri Divisions were laid out in order to study the natural regeneration of Sal. Existing plots were inspected and the inferences gained therefrom noted down.

Owing to the paucity and bad quality of the Sal seed during the past two years little progress could be made with the study of the artificial regeneration of Sal, beyond small initial experiments at Dehra Dun.

A Bulletin was published during the year showing to what extent the size and condition of Sal trees influence the seed produced.

The conclusions arrived at were that these have little to do with seed fertility.

Sample plots were laid out in order to observe whether the coppicing of Sal trees flush with the ground or at some little distance above it gave the best results, also as to the effect of burning newly coppiced coupes.

A note as to the causes and effect of drought in Sal areas in Oudh was sent to the Press just after the year closed.

21 permanent Sal sample plots were laid out with the object of compiling yield tables.

Systematic thinnings of varied intensity were carried out in connection with the highest volume increment per acre under different conditions.

The effects of subterranean water level and geological formation were examined with reference to drought. There is no doubt that the lowering of the water level consequent on deficient rainfall and the presence of thick strata of sand in the subsoil are very important factors; and the damage done may generally be ascribed to these causes. In addition many miscellaneous notes on matters relating to Sal were recorded.

The Uniform and Group Methods in respect to Deodar, Chir, and Karshu Oak were studied in the hills of the United Provinces, while visits were paid, in order to measure up Eucalyptus plantations, to Madras, and Deodar to the hills of the Chakrata Division, United Provinces.

The experimental bamboo plots laid out in the previous year were examined and the prescribed cuttings carried out.

The cultivation on Lac on the "*Butea frondosa*" was carried on in the Siwalik Division.

32 experimental plots were laid out in the United Provinces in order to collect statistical information on species other than Sal, and volume measurements of Deodar, Blue pine and Chir were made in 43 sample plots, not permanently demarcated. The experimental plots in the Chakrata Division where *Podophyllum Emodi* is being cultivated were inspected.

An immense amount of statistical information was collected which it will take a considerable time to write up.

Mr. Troup writes that at all times he has received cordial assistance from officers of the Department which has much facilitated research. He is often hard pressed to cope with the numerous enquiries received, which, however, tend to show that his work is meeting a very real demand.

The experimental gardens at Dehra Dun aggregating 11·5 acres were kept in good order, masonry water channels, a water tank and potting shed have been constructed and the areas fenced in.

The two posts of assistants on the temporary establishment sanctioned in the previous year have been more than justified by progress made.

(*b*) *Forest Botany.*

Investigation of Sal problems was continued with special reference to soil moisture and light. It is now evident that Sal seedlings die when the moisture content of the soil in contact with their roots falls below 1 per cent. in sand and 2 per cent. in heavy loam.

Mr. Hole has clearly shown the *primâ facie* unsuitability of grass lands of *Saccharum Munja* for the growth of Sal.

The results of his work to date are about to be published. An extended series of experiments has been arranged for the further study of soil moisture and light in relation to the healthy development of Sal.

The study of forest grasses was continued in order to focus attention on the more valuable species and facilitate their investigation, to determine the best treatment to apply to grass lands with the object of realizing on the one hand the best economic return, and on the other of facilitating afforestation where the production of grass is not the chief desideratum, and to determine, in conjunction with the Forest Economist and Chemist, the economic value of various species in relation to fodder, pulp, etc. The Forest Officers of the United Provinces are now preparing maps showing roughly in each division the areas occupied by the chief dominant grasses. This information will be of much value in connection with pulp factories, fodder reserves, etc.

22 carefully identified species of grasses were sent to Mr. Raitt, the pulp Specialist, during the year and a preliminary examination was made of them which indicated that 14 of the 22 promised to be of considerable value for higher grade paper pulp.

Mr. Hole drew prominent attention to the fact that the Burmese "Kaing" grass which many thought was of one species only is a name commonly applied to at least 15 different species and is a general Burmese term given to many large grasses.

Incidentally grasses supposed to occur only in one province or region have now been conclusively shown to occur elsewhere, while grasses have been examined which promise to be entirely new species.

Specimens of *Xylia* were received from different parts of India and Burma, and from an examination of these it seems probable that the Indian tree will have to be distinguished from the Burman as *Xylia xylocarpa* as against *Xylia dolabriformis*. Further study of the point is, however, necessary.

The study of the *Grewias*, a very complicated one, was continued, and the results will, it is hoped, be given to the public in 1912-13.

The identification of specimens was carried out on a large scale—246 were identified against a previous total of 50, which has resulted in the discovery of three probably new species of *Albizzia*, *Terminalia* and *Litsœa*, respectively. This identification work has to be done entirely by the Botanist as there is no one else capable of it, and takes up a very large amount of his time. At the same time the President considers it to be of the first importance, as it keeps the Research Institute in touch with the Department and indicates to the latter that the Botanist is doing his best to help it at much inconvenience to himself. This promotes cordiality and confidence between the Institute and Officers of the Department which would be the case to a far lesser extent if officers had to send their specimens for identification elsewhere. With the advent of local forest floras much of this identification work would be obviated.

Many exotics have been promiscuously planted and cultivated in India, leading to much waste of time and money. The Botanist is collecting notes on the most valuable exotics and the conditions suitable to them, with a view to preventing money being wasted on species of no promise or of no economic importance.

A commencement has been made on collecting notes on the spike disease of Sandal, while the preliminary investigation of the attack of *Trametes Pini* on the blue pine has been all but completed and is being got ready for publication.

The herbarium is being steadily extended. 1,058 sheets were added during the year, valuable contributions having been received from the Calcutta Botanical Garden, from Mr. Lace, Chief Conservator of Forests, Burma, and from Mr. Maiden of Sydney.

A card index catalogue of the herbarium is under preparation. This has now become essential.

35 works were added to the Botanist's Library during the year costing Rs. 860.

Mr. Hole writes: "Local Forest Officers have as usual generously assisted the Botanist in his work with specimens and information, and more particularly the Forest Officers of Burma, for which special thanks are due to Mr. J. H. Lace."

(c) *Forest Economy.*

The most important work carried out during the year was as follows:—

Examination with practical tests were conducted at Sibpur into the technical properties of Sal timber, as also its seasoning. Notes were collected on the figures of outturn, uses, durability and prices of the same timber. The information got together will, it is hoped, be published shortly.

The available supply of suitable timbers in portions of the Oudh forests was examined with reference to the establishment of a match factory. The supply of timber was found to be sufficient. Samples of timber from the Sunderbans and Madras were tested and found to be suited for match making.

The enquiry into the feasibility of preparing paper pulp from bamboo was continued during the year, additional areas having been examined in Assam. The results are full of promise and a record on the subject is on the eve of publication.

The antiseptic treatment of sleepers was looked into and *Terminalia*, *dipterocarp* and pine sleepers were treated under the powellizing process and others of the same kinds with *Avenarius Carbolineum*. These were laid down on the principal Railways and their behaviour is being carefully watched.

The Economist toured in Assam in connection with the tea box industry and collected much information on the subject, which, however, had not been put together by the end of the year.

The examination into the economic values of various gums and resins and the best methods of extracting such was continued.

Samples of woods have been supplied for various small industries such as pencils, tool handles, hand looms, cement barrels, veneers, musical instruments, packing cases, etc., with varying results.

Figures of outturn and cost of 7 species of tan barks were collected from the various provinces. This is the preliminary to testing the tanning value and trade possibilities of such barks.

Logs of three species were sent to the Bombay, Baroda and Central India Railway at Ajmer to meet the demand for timber for ballast trucks.

Logs have been sent to England to be tested for "Venesta Veneers."

The above represents only a short sketch of the work got through by the Economist during the year. Nearly every post brings him some enquiry or another, many of them having nothing whatever to do with his work, but which require a reply. In addition to this the information collected by him has to be carefully ledgered, so that it is difficult to see how the current work of his office is to continue to be kept up to date without assistance.

The Museum Collections were enlarged and carefully looked after, many of the specimens are still in their boxes, there being no room to display them and must remain so until the new buildings are erected.

The ledger files, some 1,800 in number, from the Reporter on Economic Products were handed over to the Research Institute. The boxes are lying unopened, there is no one with leisure to sort the files or classify them, and until some assistance is given, matters will remain *in statu quo*.

The two publications, "Notes on the Antiseptic Treatment of Timber," and "The Commercial Guide to the Forest Economic Products" written by Mr. Pearson have been most favourably received by the public in India and Europe and both have been highly reviewed. They meet a real want.

The assistance, and naturally much assistance was required, given to the Economist by the Department was in general most praiseworthy especially in the preparation of sleepers for antiseptic treatment.

(*d*) *Forest Chemistry.*

Small samples of Sal Tan extracts were sent to England for report and valuation, but no reply had come at the close of the year.

Samples of leaves and wood of *Cinnamomum glanduliferum* received from Assam were analysed yielding under ·5 per cent. of oil and no trace of solid camphor. It is stated that camphor is being extracted from this species in the Shan States, it is thus doubtful whether the Assam and Burma species are identical. The question has been referred to the Forest Botanist and Economist.

Mangrove tannin extract.—This investigation has advanced a stage and the results are in the Press.

Samples of turpentine extracted from the *Pinus longifolia* and *Pinus excelsa* were sent to London for valuation; no reply had, however, been received by the close of the year.

Specimens of myrabolans were examined for their tannin value. The conclusions come to were that the fruit contained the maximum of tannin when quite ripe, thus the longer it remained on the tree the better.

During eight months of the year the Chemist had much of his time occupied in the examination of Sal soils. 45 specimens were analysed. The President is of opinion that the time taken up on such examinations is not justified by results. It is well known that the examination of the chemical composition of soils gives very negative data. Minor investigations were made on specimens of *Acacia Catechu, Canarium Bengalense* resin, *Boswellia Serrata* gum, *Podophyllum Emodi, Sandalwood, etc.*, at the instance of various parties and the results sent them as far as possible.

It should be borne in mind that the main rôle of the Chemist is to assist the other officers of the Institute, especially the Economist, and that thus he has little time for independent experimental work. He is much hampered by want of proper plant and until the new Laboratory is completed and properly fitted up, his work must suffer for want of appliances and conveniences. He received much assistance from officers of the Department.

(*e*) *Forest Zoology.*

The principal works undertaken were :—

(1) the study of insects affecting Sal. The Zoologist toured extensively in the forests of the United Provinces in this connection. The main conclusions come to are that two longicorns are the only widely distributed insects that cause lasting damage to Sal, and special attention is being devoted to their life history. One of these, the *Hoplocerambyx spinicornis*, was previously stated not to occur in these provinces; the Zoologist has proved this to be incorrect, he has found it plentiful. Various specimens of defoliating insects were received and identified; two new species of parasitic *Hymenoptera* were described by Mr. Cameron to whom they had been sent.

(2) The investigation of the lac insect was systematically undertaken. This was necessitated owing to the little information available and in the words of the Zoologist "in consequence of the fact that much of the literature at present available contains numerous errors relating to this insect and very little first hand information....." A large number of lac parasites quite new to science were bred out and described by Mr. Cameron.

A somewhat serious insect attack on the chir pine of the Naini Tal Division was investigated and the life history of the "Coccid" is being studied. A study of the various kinds of Termites in Indian forests is in hand, Professor Silvestri of Italy undertaking the identification. Numerous enquiries were received from officers of the Department and replied to,

The Reference Collection is now in good order, the register of specimens is complete and up to date, and details of each species have been entered in a card catalogue dealing with the whole collection. About 1,600 research files have been opened. Towards the close of the year the total number of species represented was 1,755. A good collection of *larvæ* and *pupæ* in spirits is being formed. 40 parcels of specimens were sent to various specialists in Europe for identification, and several have been described.

Dr. Imms has not been long in charge of the Zoology Branch, but has already made his presence felt and is gaining the confidence of the Department. This branch has had much against it in frequent changes of officers, none of them trained Scientists in Zoology, but under the guidance of Dr. Imms there has been a very material change for the better and there is now little doubt that progress will be as rapid as in the other branches of the Institute.

SECTION 3.—Collections and Records.

(*a*) *Museums and Collections.*

These have been generally noted upon in the previous section.

Mr. Troup besides adding to the sylvicultural specimens for which, however, there is little room available, has greatly improved the photograph collection which is in his charge. 561 new photos were added during the year bringing the total to over 1,600, and 328 negatives, the total of which is nearly 1,000. The catalogue compiled with much care was about to issue at the close of the year.

(*b*) *Ledgers.*

The remarks made last year apply. This is on a satisfactory footing.

(*c*) *Library.*

Many new books have been purchased, but the library is still very incomplete. Dr. Imms estimates that some Rs. 24,000 will have to be spent before he has what he requires. At present he has no means of identifying many insects. Matters will rectify themselves by degrees.

Mr. Nand Mal had charge of the general library, the catalogue of this has now issued and reflects credit upon him.

(*d*) *Publications.*

In Appendix I will be found a list of publications that issued during the year or that are in type. Appendix II shows all the publications issued by the Institute since it came into existence.

(*e*) The various indents received for seeds, specimens, etc., have been complied with as far as possible and the results are shown in Appendix III.

(*f*) *Tours of Officers.*

There is nothing special to note. The tours are sanctioned in the first instance by the Inspector General of Forests and are carried out as circumstances demand.

CHAPTER III.

Financial.

The expenditure of the past two years is compared below.

Budget Head.	Expenditure during the year		Difference + or —
	1910-11.	1911-12.	
	Rs.	Rs.	Rs.
AVI—Stores Tools and Plant	7,452	5,957	— 1,495
AVII—Buildings, etc.	181	2,806	+ 2,625
AIX—Miscellaneous	13,464	14,855	+ 1,391
BIa—Conservators	2,850	8,520	+ 5,670
BIb—Superior Officers	43,251	64,757	+21,506
BIc—Subordinate, Forest and Depôt Establishment	874	2,092	+ 1,218
BId—Office Establishment	19,443	23,946	+ 4,503
BIe—Deputation and Special allowances	6,322	7,718	+ 1,396
BII—Travelling Allowances	9,501	8,897	— 604
BIII—Contingencies	17,034	18,877	+ 1,843
Total	1,20,372	1,58,425	+38,053

The decrease under AVI was due to purchase of less furniture for the Research Institute. The increase under AVII is due to repairs, etc., of buildings having been placed in the hands of the President instead of the Public Works Department, under AIX to more work in the Chemical Laboratory, experiments in connection with antiseptic treatment of timbers, laying out of sample plots, etc., and to the gradual expansion of work generally in every branch of the Institute.

The increase under BIa is due to half the pay of the President having been charged to the Institute for 9 months instead of for 3 months as in the previous year.

The increase under BIb is due to the appointment of Dr. A. D. Imms as Forest Zoologist and to the pay of the Officer in Charge Forest Publications having been charged to the Institute for 12 months instead of 3 months as in the previous year. It may also be noted that the decrease in expenditure under this head in the previous year (1910-11) was due to the departure on 9 months' leave of Mr. R. S. Hole, Forest Botanist, no officer having been appointed in his place.

The increase under BIc is due to the Assistants to the Sylviculturist having been employed throughout the year instead of for a few months as in the previous year.

The increase under BId is due to the Extra Temporary Establishment having been employed throughout the year.

The increase under BIe is due to no saving being possible as in the previous year when Mr. Hole proceeded on leave.

The decrease under BII is due to no extensive tours having been undertaken by the Forest Chemist.

The increase under BIII is due to the purchase of books on Botany, Zoology and Chemistry and to charges on illustrating Forest Publications.

CHAPTER IV.

Miscellaneous.

The Programme of the work of the year will be found in Appendix IV. It has been worked up to as far as possible.

Establishment.—As usual the Institute was shorthanded. If work is to continue to develop on the present lines there can be no doubt that the various officers must be supplied with gazetted assistants, otherwise investigations must be curtailed, and the Institute will lose much of its value. At present its cost is an Imperial charge, while the revenue that it helps to create goes almost entirely to the Provinces. It is not clear therefore why the different provinces should not contribute to pay for its expansion, *e.g.*, for the assistants now required, at any rate pending such time as they establish Institutes of their own.

Buildings.—Much inconvenience has occurred owing to the non-construction of the necessary buildings. This delay is most regrettable in every way. The President has done what he could, but the case is not in his hands. Considering the unsuitability of the present temporary accommodation and the inconveniences resulting therefrom, the work in the various branches has been most praiseworthy.

Some petty additions were made to existing buildings costing Rs. 1,109, while Rs. 1,037 were spent on annual repairs, etc.

Branch offices.—These were all inspected during the year and found in good order.

Miscellaneous.—The services of Mr. Raitt, paper pulp expert, were engaged up till the middle of March.

He has issued a most useful note on bamboo pulp and its suitability for paper making, and made a preliminary examination of various grasses with the same object in view. His conclusions will, it is hoped, go to the Press in the current year.

The work of the various officers attached to the Institute has been very thorough. They are now far more in touch with the Department than was formerly the case, their methods are becoming better known and better appreciated, while care is taken not to call upon outside officers for assistance, specimens, etc., beyond what is actually necessary.

The control office was well looked after by Babu Nripendra Nath De.

The President, on his own behalf as also on that of his staff, takes this opportunity of cordially acknowledging the assistance given by members of the Department and others, without which an Institute brought into being by the foresight and perseverance of a former Inspector-General of Forests, would lose its usefulness and might possibly cease to exist.

L. MERCER,

President, Forest Research Institute and College.

APPENDIX I.

List of Forest Publications put into type during the year 1911-12.

Branch of Research.	Name of Publication.	Author.	Form in which issued.	Remarks.
Botany Series	I.—Bulletins.			
	Nil.			
	II.—Records.			
	Note on Useful Exotics in Indian Forests (No. 1 *Prosopis Juliflora*, D.C.)	R. S. Hole . .	Record . . .	In Press.
	Note on *Albizzia Lathamii* .	Do. . .	Do. . . .	Do.
	III.—Memoirs.			
	Nil.			
Chemistry Series	I.—Bulletins.			
	Note on Resin value of *Podophyllum Emodi* and the best season for collecting it.	Puran Singh . .	Bulletin No. 9 .	Issued in February 1912.
	II.—Records.			
	Note on the Distillation of Turpentine Oil from the Chir Resin in India and on Clarification of Indian Rosin.	Do. .	Record . . .	In Press.
	Note on the Preparation of Tannin Extracts with special reference to those prepared from the bark of Mangrove (*Rhizophora mucronata*).	Do. .	Record, Vol. III, Part IV.	Issued in August 1912.
	Note on the Resin Industry and Turpentine and the Colophony Manufacture in the Naini Tal Division.	E. A. Smythies .	Record . . .	In Press.
	III.—Memoirs.			
	Nil.			
	IV.—Manuals.			
	Nil.			
	V.—Other Publications.			
	* Report on the Preparation of Mangrove Tannin Extracts with special reference to the Government Factory at Rangoon.	Puran Singh . .	'Record size' .	Issued in April 1912. * (Not intended for general distribution.)
Economy Series	I.—Bulletins.			
	Note on *Ougeinia dalbergioides* .	A. Rodger . .	Bulletin . .	In Press.
	Do. *Terminalia tomentosa* .	Do. . .	,,	Do.
	Do. *Gmelina arborea* . .	Do. . .	,,	Do.
	Do. *Pterocarpus Marsupium* .	Do. . .	,,	Do.
	Do. *Lagerstræmia lanceolata* .	Do. . .	,,	Do.
	Do. *Anogeissus latifolia* .	Do. . .	,,	Do.
	II.—Records.			
	Report on the Investigation of Bamboo as Material for Production of Paper-pulp.	W. Raitt . .	Record, Vol. III, Part III.	Issued in July 1912.
	III.—Memoirs.			
	Nil.			

List of Forest Publications put into type during the year 1911-12—contd.

Branch of Research.	Name of Publication.	Author.	Form in which issued.	Remarks.
Sylviculture Series.	I.—Bulletin.			
	Note on Some Germination Tests with Sa seed (*Shorea robusta*).	R. S. Troup . .	Bulletin No. 8 .	Issued in February 1912.
	II.—Records.			
	Nil.			
	III.—Memoirs.			
	Nil.			
	IV.—Manuals.			
	Second Edition of the Manual of Forest Utilization.	R. S. Troup . .	Manual . . .	In Press.
	Surveying and Drawing Manual .	D. N. Avasia and F. A. Brining.	Do. . . .	Do.
Working Plan Series.	I.—Bulletins.			
	Nil.			
	II.—Records.			
	Nil.			
	III.—Memoirs.			
	IV.—Manuals.			
	Working-Plan for the Thano Forests of the Siwalik Division.	R. S. Troup . .	'Manual size' .	Intended for sale, to the Extra Assistant Conservators' class only. (Issued in December 1911.)
	V.—Other Publications.			
	Catalogue of the Photographic Collection at the Forest Research Institute, Dehra Dun.	Do. . .	Do. . .	In Press.
Zoology Series.	I.—Bulletins.			
	Note on the Bark-eating and Root-boring Beetles of the Babul (*Acacia arabica*).	E. P. Stebbing .	Bulletin, No. 12 .	Issued in June 1912.
	Note on some *Casuarina* Insect Pests of Madras.	V. Subramania Iyer	Bulletin No. 11 .	Issued in May 1912.
	Note on the Bark-boring Beetle Attack in the Coniferous forests of the Simla Catchment Area, 1907-11.	R. S. Hole . .	Bulletin No. 10 .	Do.
	II.—Records.			
	Note on the Parasitic *Hymenoptera* reared at Dehra Dun, Northern India, from the Lac (*Tachardia*) and Sal Insects and on some new and other species of Non-parasitic *Hymenoptera* in the Collection of the Zoological Branch of the Forest Research Institute, Dehra Dun.	P. Cameron . .	Record . .	In Press.
	III.—Memoirs.			
	Nil.			

APPENDIX II.

List of all Forest Publications issued since the creation of the Forest Research Institute.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
		I.—Bulletins (Old Series).			*Rs. a. p.*	
1	Zoology .	Note upon the Bee-Hole borer of Teak in Burma.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Bulletin No. 1	0 4 0	Issued in 1905.
2	Do. .	Note on the Quetta Borer (*Æolesthes sartus*).	Do. do. .	Do. 2	0 8 0	Do.
3	Do. .	Note on the Chilgoza (*Pinus Gerardiana*) Bark-boring Beetles of Zhob, Baluchistan.	Do. do. .	Do. 3	0 8 0	Do.
4	Economy .	*Ficus elastica*: its natural growth and artificial propagation; with a description of the method of tapping the tree and of the preparation of its rubber for the market.	E. M. Coventry, I.F.S., Deputy Conservator of Forests.	Do. 4	0 12 0	Issued in 1906.
5	Zoology .	Notes on a Visit to some European Schools of Forestry.	E. P. Stebbing I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 5	2 0 0	Issued in 1905.
6	Economy .	Memorandum on Mechanical Tests of some Indian Timbers.	W. H. Everett, B.A., B.E., M.I. Mech. E., M.I.E.E., Professor of Mechanical and Electrical Engineering, Sibpur Engineering College.	Do. 6	0 2 0	Issued in 1906.
7	Zoology .	Note on the Chilgoza Forests of Zhob and the Takht-i-Suliman.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 7	0 12 0	Do.
8	Do. .	Note on the Life-history of *Hoplocerambyx Spinicornis* (the Singbhum Sal Borer).	Do. do. .	Do. 8	0 9 0	Do.
9	Sylviculture .	Notes on the Influence of Forests on the Storage and Regulation of the Water Supply.	S. Eardley-Wilmot, I.F.S., C.I.E., Inspector-General of Forests to the Government of India.	Do. 9	1 0 0	Do.
10	Zoology .	Note on the Duki Fig Tree Borer of Baluchistan (*Batocera rubus*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 10	0 7 0	Do.
11	Do. .	On some Assam Sal (*Shorea robusta*) Insect Pests.	Do. do. .	Do. 11	1 10 0	Do.
		II.—Leaflets.				
1	Zoology .	The Sal Bark Borer (*Sphœrotrypes siwalikensis*, Steb.)	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Leaflet No. 1	0 4 0	Issued in 1908.
2	Do. .	The Teak Defoliator (*Hyblœa puera*, Cram).	Do. do. .	Do. 2	0 2 0	Do.
3	Do. .	The Teak Leaf Skeletoniser (*Pyrausta machœralis*, Wlk).	Do. do. .	Do. 3	0 2 0	Do.

Note.—The Leaflet Series has been discontinued.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
		II.—Leaflets—*contd.*			*Rs. a. p.*	
4	Zoology .	The Larger Deodar Bark Borer (*Scolytus major*, Steb.).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Leaflet No. 4	0 4 0	Issued in 1910.
5	Do. .	The Blue Pine "*Polygraphus* Bark Borer" (*Polygraphus major*, Steb.).	Do. do. .	Do. 5	0 3 0	Do.
		III.—Pamphlets.				
1	Chemistry .	Note on the Utilization of Khair forests in Eastern Bengal and Assam.	Puran Singh, F.C.S., Acting Forest Chemist.	Pamphlet No. 1	0 4 0	Issued in 1908.
2	Zoology .	The Attack of Barkboring Beetle in the Coniferous forests on the Simla Catchment Area.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 2	0 8 0	Do.
3	Working-Plans	A Glossary of Technical Terms for Use in Indian Forestry.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent, Forest Working-Plans.	Do. 3	0 4 0	Do. (Revised and issued as Bulletin No. 4, New Services).
4	Economy .	Lac and Lac cultivation	D. N. Avasia, Extra Assistant Conservator of Forests.	Do. 4	0 2 0	Issued in 1909.
5	Sylviculture	Notes on Sal in Bengal .	A. L. McIntire, I.F.S., Conservator of Forests, Bengal.	Do. 5	0 4 0	Do.
6	Do.	Forest Reservation in Burma in the interests of an Endangered Water-supply.	A. Rodger, I.F.S., Deputy Conservator of Forests.	Do. 6	1 0 0	Do.
7	Economy .	Andaman Marble Wood or Zebra Wood (*Diospyros Kurzii*, Hiern).	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Do. 7	0 4 0	Do.
8	Working-Plans	The Collection of Statistical Data relating to the principal Indian Species.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superindent of Forest Working-Plans.	Do. 8	0 10 0	Issued in 1910.
9	Do. .	Tables showing the Progress in Working-Plans in the Provinces outside the Madras and Bombay Presidencies up to 31st December 1908.	Do. do. .	Do. 9	0 10 0	Do.
10	Economy .	Note on Burmese Leza Wood (*Lagerstræmia tomentosa*, Presi).	R. S. Troup, I.F.S., F. C.H., Forest Economist.	Do. 10	0 2 0	Do.
11	Do. .	Note on Carallia Wood (*Carallia integerrima*, D.C.).	Do. do. .	Do. 11	0 2 0	Do.
12	Do. .	Petwun or Trincomali Wood (*Berrya Ammonilla*, Roxb.).	Do. do. .	Do. 12	0 4 0	Do.
13	Do. .	Burmese In Wood (*Dipterocarpus tuberculatus*, Roxb.).	Do. do. .	Do. 13	1 0 0	Issued in 1909.
14	Do. .	Burma Padauk (*Pterocarpus macrocarpus*, Roxb.).	Do. do. .	Do. 14	1 0 0	Do.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
					Rs. a. p.	
		III.—Pamphlets—*contd.*				
15	Zoology .	Note on the Preservation of Bamboos from the Attacks of the Bamboo Beetle or "Shot-Borer."	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S.	Pamphlet No. 15	0 7 0	Issued in 1910.
16	Botany .	Note on Best Season for Coppice Fellings of Teak.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S.	Do. 16	0 4 0	Do.
		Note.—The Pamphlet Series has been discontinued.				
		IV.—Bulletins (New Series).				
1	Chemistry .	Note on Calorimetric Tests of Some Indian Woods.	Puran Singh, F.C.S., Forest Chemist.	Bulletin No. 1	0 2 0	Issued in 1911.
2	Sylviculture .	Memorandum on Teak Plantations in Burma.	F. A. Leete, F.C.H., Dy. Conservator of Forests, Burma.	Do. 2	0 10 0	Do.
3	Economy .	Note on the Relative Strength of *natural* and *plantation-grown* Teak in Burma.	R. S. Pearson, F.L.S., Forest Economist.	Do. 3	0 4 0	Do.
4	Sylviculture	Second Edition of Mr. Caccia's Glossary of Technical Terms for use in Indian Forestry.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. 4	0 6 0	Do.
5	Zoology .	The Blue Pine *Tomicus* Bark-Borer.	E. P. Stebbing, F.L.S., F.Z.S., F.R.G.S., F.E.S.	Do. 5	0 2 0	Do.
6	Chemistry .	Note on the Oil Value of Sandal wood.	Puran Singh, F.C.S., Forest Chemist.	Do. 6	0 2 0	Issued in 1912.
7	Do. .	Note on the Chemistry and Trade forms of Lac.	Do. do. .	Do. 7	0 3 0	Do.
8	Sylviculture	Note on some Germination Tests with Sal seed (*Shorea robusta*).	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. 8	0 2 0	Do.
9	Chemistry .	Note on Resin Value of *Podophyllum Emodi* and the best season for collecting it.	Puran Singh, F.C.S., Forest Chemist.	Do. 9	0 1 3	Do.
10	Zoology .	Note on Bark-Boring Beetle attack in the Coniferous Forests of the Simla Catchment Area, 1907-11.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S.	Do. 10	0 3 0	Do.
11	Do. .	A Further Note on some *Casuarina* Insect Pests of Madras.	V. Subramania Iyer, M.A., F.L.S., F.Z.S., late Forest Zoologist.	Do. 11	0 14 0	Do.
12	Do. .	Note on the Bark-Eating and Root-Boring Beetles of Babul (*Acacia arabica*).	E. P. Stebbing, F.L.S., F.Z.S., F.R.G.S., F.E.S.	Do. 12	0 4 0	Do.
		V.—Records.				
1	Zoology .	A Note on the Lac Insect (*Tachardia lacca*), its Life-History, Propagation and Collection.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Record, Vol. I, Part I.	1 4 0	Issued in 1908.
2	Working-Plans	A Preliminary Note on the Development of the Sal in Volume and in Money Value.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working-Plans.	Record, Vol. I, Part II.	1 4 0	Do.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
		V.—Records—*contd.*			*Rs. a. p.*	
3	Economy .	*Pterocarpus dalbergioides*, Roxb. (Andaman padauk).	B. B. Osmaston, I.F.S., Conservator of Forests, United Provinces.			
4	Zoology .	A Further Note on the Chilgoza Bark-Boring Beetles of Zhob.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.			
5	Economy .	A Note on the Present Position and Future Prospects of the Cutch Trade in Burma.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Record, Vol. I, Part III.	1 4 0	Issued in 1908.
6	Chemistry .	Note on the Manufacture of Ngai Camphor.	Puran Singh, F.C.S., Acting Forest Chemist.			
7	Do. .	A Chemical Investigation of the Constituents of Burmese Varnish (*Melanorrhœa usitata*, Sap.).	Do. do. .			
8	Working-Plans	The Selection System in Indian Forests as exemplified in Working-Plans, based on this system, with a short description of some Continental Methods.	A. M. F. Caccia, I.F.S., M.V.O. F.Z.S., Superintendent of Forest Working-Plans.	Record, Vol. I, Part IV.	1 4 0	Do.
9	Zoology .	Note on Some Insect Pests of the Himalayan Oaks (*Quercus dilata* and *Quercus incana*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Record, Vol. II, Part I.	0 6 0	Do.
10	Economy .	Note on the Fissibility of some Indian Woods.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Record, Vol. II, Part II.	1 6 0	Issued in 1910.
11	Sylviculture.	Monograph on the Sylviculture of *Hardwickia binata* (Anjan).	D. O. Witt, Dy. Conservator of Forests, Central Provinces.	Record, Vol. II, Part III.	3 4 0	Do.
12	Botany .	Notes on Sandal (Germination and Growth of Sandal Seedlings).	Rao Sahib M. Rama Rao Garu, Conservator of Forests, Travancore.			
13	Do. .	Note on Host Plants of the Sandal Tree.	Do. do. .	Record, Vol. II, Part IV.	2 0 0	Issued in 1911.
14	Working-Plans	Note on some Statistical and other Information regarding the Teak Forests of Burma.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Record, Vol. III, Part I.	2 12 0	Do.
15	Economy .	Preliminary Note on the Antiseptic Treatment of Timber in India with special reference to Railway Sleepers.	R. S. Pearson, I.F.S., F. L. S., Forest Economist.	Record, Vol. III, Part II.	0 14 0	Issued in 1912.
16	Economy .	Report on the Investigation of Bamboo as a material for Production of Paper-pulp.	W. Raitt, F.C.S., Cellulose Expart.	Record, Vol. III, Part III.	0 6 0	Do.
17	Chemistry .	Note on the Preparation of Tannin Extracts, with special reference to those prepared from the Bark of Mangrove (*Rhizophora mucronata*).	Puran Singh, F.C.H., Forest Chemist.	Record, Vol. III, Part IV.	0 7 0	Do.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued	Price.	Remarks.
					Rs. a. p.	
		VI.—Memoirs.				
1	Zoology .	On some Undescribed *Scolytidæ of* Economic Importance from the Indian Region I.	E. P. Stebbing, F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Memoir, Vol. I, Part I.	0 4 0	Issued in 1908.
2	Do. . .	Second Monograph on some Undescribed *Scolytidæ* of Economic Importance from the Indian Region II.	Do. do. . .	Memoir, Vol. I, Part II.	0 4 0	Issued in 1909.
3	Do. . .	Second Edition of the Monograph on "Lac Insect" (*Tachardia lacca*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S.	Memoir, Vol. I, Part III.	1 0 0	Issued in 1910.
4	Do. . .	Note on Some Important Insect Pests of the Himalayan Coniferæ (treating Deodar).	Do. do. . .	Memoir, Vol. II, Part I.	4 10 0	Issued in 1911.
5	Chemistry .	Note on the Analysis of Cutch and the Preparation of Pure Catechin.	Puran Singh, F.C.S., Acting Forest Chemist.	Memoir, Vol. I, Part I.	1 4 0	Issued in 1908.
6	Do. . .	Note on the Manufacture of Pure Shellac.	Do. do. . .	Memoir, Vol. I, Part II.	0 8 0	Issued in 1909.
7	Economy .	Indian Woods and their Uses.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Memoir, Vol. I, Part I.	2 12 0	Issued in 1908.
8	Do. . .	Note on the Prospects of the Match Industry in the Indian Empire with particulars of Proposed Match Factory Sites and Woods suitable for Match Manufacture.	Do. do. . .	Memoir, Vol. II, Part I.	1 12 0	Issued in 1910.
9	Working-Plans	*Nil.*				
10	Botany .	Note on Some Indian Grasses and their Œcology.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S., Forest Botanist.	Memoir, Vol. I, Part I.	5 8 0	Issued in 1911.
11	Sylviculture	*Nil.*				
12	Zoology .	Note on Some Important Insect Pests of the Himalayan Coniferæ (*Pinus longifolia*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S.	Memoir, Vol. II, Part II.	1 14 0	Do.
		VII.—Manuals.				
1	Economy .	Manual of Indian Forest Utilization.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Manual . .	2 4 0	Issued in 1907.
2	Zoology .	Manual of Forest Zoology.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. . .	10 0 0 *5 0 0	Issued in 1908.
3	Botany .	Manual of Forest Botany	R. S. Hole, I.F.S., F.C.H., F.L.S., F.E.S., Forest Botanist.	Do. . .	3 8 0	Issued in 1909.
4	Working Plans	Revised Fourth Edition of D'Arcy's Preparation of Forest Working-Plans in India.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working-Plans.	Do. . .	0 14 0	Issued in 1910.
5	Sylviculture	Second Edition of the Concise Manual of Sylviculture.	....	Do. . .	1 0 0	Issued in 1911.
6	..	Manual of Forest Law .	....	Do. . .	1 0 0	Issued in 1906.
7	Working-Plans	Manual of Forest Mensuration.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. . .	1 4 0	Issued in 1911.

* For Officers below Extra-Deputy Conservators.

List of all Forest Publications issued since the creation of the Forest Research Institute—concld.

Serial No.	——	Price.	Remarks.
	VIII.—Other Publications.	*Rs. a. p.*	
1	Practical Determination of the Girth Increment of Trees, by R. S. Troup, Sylviculturist	0 4 0	Issued in 1910.
2	Forest Flora of Chota Nagpur, by H. H. Haines, Conservator of Forests, Central Provinces.	9 0 0	Do.
3	Translation of M. Jacquot's "Incendies en Forêt," by C. E. C. Fischer, Dy. Conservator of Forests.	0 14 0	Do.
4	Tables for the Volume Measurement of Sample Plots, by R. S. Troup, Sylviculturist	0 8 0	Do.
5	Descriptive Catalogue of the Economic Museum of the Forest Research Institute and College, by R. S. Pearson, Forest Economist.	1 4 0	Issued in 1911.
6	Forest Flora of the Siwalik and Jaunsar Divisions, United Provinces (revised edition), by Rai Bahadur U. N. Kanjilal.	*1 4 0 †1 14 0	Do.
7	Working-Plan for the Thano Forests of the Siwalik Division by R. S. Troup, Sylviculturist	2 0 0	Do.
8	Report on the Preparation of Mangrove Tannin Extracts with special reference to the Govt. Factory at Rangoon, by Puran Singh, F.C.S., Forest Chemist.	*	Issued in 1912. (Not for sale or general distribution).
9	Commercial Guide to the Economic Forest Products of India, by R. S. Pearson, F.L.S., Forest Economist.	1 0 0	

* For students. † For the public.

APPENDIX III.

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1911-12.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
10th July 1911.	The Conservator of Forests.	Forest Botanist.	*Pinus Mercusii*	Seed	13 lbs.	
1st September 1911.	Lagos, Southern Nigeria	Do.	*Chloroxylon Swientenia.*	Do.	13 lbs.	
13th July 1911	The Consul General for Portugal.	Do.	*Salvadora persica*	Do.	13 lbs.	
21st July 1911	Bombay	Do.	*Capparis aphylla*	Do.	7 lbs.	
18th December 1911	The Chief Conservator of Forests, Nairobi	Do.	*Cedrela serrata*	Do.	7 lbs.	
31st July 1911	The Chief Conservator of Forests, British East Africa Protectorate.	Do.	*Michelia nilagirica*	Do.	3 lbs.	
10th July 1911	The Chief Conservator of Forests, Nairobi.	Do.	*Dendroca lamus giganteus.*	Do.	5 lbs.	
10th July 1911	Do.	Do.	*Bambusa Brandisii*	Do.	5 lbs.	
10th July 1911	Do.	Do.	*Bambusa Tulda*	Do.	5 lbs.	
31st July 1911	Do.	Do.	*Gmelina arborea*	Do.	3 lbs.	
24th August 1911	Do.	Do	*Eugenia arnottiana*	Do.	3 lbs.	
24th August 1911	Do.	Do.	*Acrocarpus fraxinifolia.*	Do.	3 ozs.	
9th September 1911	Do.	Do.	*Michelia Champaca*	Do.	6 lbs.	
15th November 1911	Do.	Do.	*Abies Pindrow*	Do.	1 lb.	
6th January 1912	Do.	Do.	*Cedrela serrata*	Do.	10½ lbs.	
3rd July 1911	Mons. Dode, 4 Place du Maine, Paris (15°) France.	Do.	*Salix Wallichiana*	Cuttings	8 cuttings	
Do. do.	Do. do.	Do.	*Salix daphnoides*	Do.	Do.	
Do. do.	Do. do.	Do.	*Salix elegans*	Do.	Do.	
Do. do.	Do. do.	Do.	*Populus ciliata*	Do.	Do.	
19th January 1912	Do. do.	Do.	*Quercus langinosa*	Seed	2 lbs.	
25th September 1911	The Chief Conservator of Forests, Union of South Africa.	Do.	*Pinus longifolia*	Do.	111 lbs.	
15th November 1911	Forest Department, C/o the Railway Storekeeper, Cape Town.	Do.	*Abies Pindrow*	Do.	1 lb.	
22nd January 1912	Do. do.	Do.	*Picea Morinda*	Do.	6 lbs.	
15th November 1911	Johannes Rafn, Esq., Copenhagen, F.	Do.	*Abies Pindrow*	Do.	10 lbs.	
11th July 1911	The Superintendent, Government Botanical Gardens, Saharanpur.	Do.	*Cedrus Deodara*	Do.	8 ozs.	
26th August 1911	The Chief Conservator of Forests, Union of South Africa, Forest Department, C/o The Railway Storekeeper, Cape Town.	Do.	*Albizzia Lebbek*	Do.	1 lb.	

Abstract from the Register of seeds, timbers and other forest produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest year 1911-12—contd.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
10th November 1911	The Superintendent, Government Botanical Gardens, Saharanpur.	Forest Botanist .	*Asparagus filicinus*	Seed .	5 oz.	
31st July 1911 .	Geo. H. Cecil, Esq., The Forester, Portland, Oregon, U. S. A.	Do. . .	*Cedrus Deodara* .	Do. .	½ lb.	
31st July 1911 .	Do. do. .	Do. . .	*Abies Pindrow* .	Do. .	½ lb.	
31st July 1911 .	Do. do. .	Do. . .	*Picca Morinda* .	Do. .	½ lb.	
14th December 1911	Do. do. .	Do. . .	*Pinus Gerardiana*	Do.	1 lb.	
26th August 1911 .	Messrs Ralli Brothers, Calcutta.	Do. . .	*Bassia butyracea* .	Do. .	10 lbs.	
5th January 1912 .	The Superintendent, Government Botanical Gardens, Saharanpur.	Do. . .	*Abies Webbiana* .	Do. .	10 lbs.	
5th January 1912 .	Do. do. .	Do. . .	*Pinus excelsa* .	Do. .	½ lb.	
22nd May 1912 .	Do. do. .	Do. . .	*Diospyros tomentosa.*	Do. .	2 lbs.	
30th January 1912 .	The Chief Conservator of Forests, Union of South Africa, Forest Department, C/o The Railway Storekeeper, Cape Town.	Do. . .	*Quercus Ilex* .	Do. .	10 lbs.	
13th April 1912 .	Do. do. .	Do. . .	*Albizzia Lebbek* .	Do. .	1 lb.	
22nd June 1912 .	Do. do. .	Do. . .	*Pinus longifolia* .	Do. .	40 lbs.	
25th June 1912 .	The Director of Forests and Gardens, Port Louis, Mauritius.	Do. . .	*Eassia longifolia* .	Do. .	5 lbs.	
17th May 1912 .	The Director General, Department of Agriculture, Cairo.	Do. . .	*Dillenia speciosa* .	Do. .	2½ ozs.	
14th June 1912 .	The Agent General in India for the British Protectorates in Africa, Bombay.	Do. . .	*Cupressus torulosa*	Do. .	2¾ lbs.	
6th July 1911 .	Rev. J. J. Chrysestom, R. C. Chaplain, Cawnpore.	Forest Economist.	45 different species	Small wood specimens.	45 Nos.	For the Museum in Italy.
15th July 1911 .	Dr. Theodore Paul, Kaiserl, Geheimer Regierungsrat Ordental, Professor-an-der-Kgl. Universitat, Munechen.	Do.	*Angeissus latifolia*,	Gum	1 lb	
			Acacia catechu,	Gum	1 lb.	
			Shorea robusta,	Dammar	1 lb.	
			Pinus longifolia.	Resin	1 lb.	
			Do. . .	Colophony	1 lb.	
			Melanorrhœa usitata.	Wood oil I, II, & III Class.	3 lbs.	
24th July 1911 .	Professor Percy Groom, Royal College of Science, London.	D. F. O., Bushahr	*Pinus gerardiana* .	Wood .	1	
15th September 1911	Do. do. .	Forest Economist.	*Castanopsis argentea* *Castanopsis Hystrix*	Wood .	2	
21st September 1911	Secretary, Midland Junction Technical School, York Road Midland Junction, Western Australia	Do. . .	159 different species.	Small wood specimens.	159	
14th October 1911.	Supply and Transport School of Instruction, Rawalpindi.	Do. . .	22 Do. .	Do. .	22	
11th December 1911.	Professor Percy Groom, Royal College of Science, London.	Conservator, Bengal.	*Juniperus Wallichiana.*	Wood .	1	

APPENDIX IV.

Part I.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Forest Research Institute Officers.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
		SYLVICULTURE.			
1	The conversion of an irregular Sal Forest into a regular Sal forest, experiment to be carried out on a practical scale, a careful working scheme being prepared for the Thano Experimental area.	Thano Experimental area, Dehra Dun District, United Provinces.	A Working-Plan to effect the desired object has been completed.	The experimental application of the Uniform Method under the working, commenced in 1910-11, and will be carried out annually in future.	
2	Experiments to ascertain the best methods of ensuring natural regeneration of Sal, severity of cuttings to bring it about, and the degree to which young Sal will stand shade.	Do. do. .	Observations are in progress.	Observations will be continued.	
3	Methods of artificially cultivating Sal and assisting natural reproduction to be tested, and experiments made.	Thano Experimental Station, Dehra Dun, United Provinces.	....	This will be commenced in the Sylvicultural Garden, Dehra Dun.	
4	The effect of age of tree on fertility and abundance of seed; the frequency of seed years; the effect of environment on the same.	Do. do. .	Extensive germination tests have been carried out in different parts of India, the results of which will be published later.	Information regarding the frequency of seed years and the effect of environment will be collected.	
5	Sal coppice experiments and fertility of coppice seed.	Gorakhpur Division, Gonda Division and other United Provinces Sal coppice areas.	Not yet commenced	Will be commenced if possible.	
6	Investigation of effects of drought, fire, frost and grazing.	For drought and fire: Kheri Division, United Provinces. For frost: Siwalik Division. For grazing: Bahraich Division.	A good deal of information has been collected.	Enquiries will be continued during the forthcoming year.	
7	Rate of growth of Sal:—				
	(i) Rate of girth and height increment in high forests.	(i) Siwalik Division.	In progress . .	Will be continued.	
	(ii) Yield Tables for Sal high forest and coppice.	(ii) Gorakhpur Division.	Not yet commenced	Measurements will be commenced if possible and continued periodically.	
8	Thinnings in uniform Sal crops; the age at which they should be commenced; their intensity, and the proper density to be maintained in crops of different ages.	Wherever uniform crops are found in the United Provinces.	Experimental plots are being laid out.	This work will be continued.	
9	Effect of subterranean water level and of geological formation (and soil drainage) on Sal development.	Kheri Division .	A considerable amount of information has been collected.	Investigations will be continued.	

Part I.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Forest Research Institute Officers—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			SYLVICULTURE—*contd.*		
10	Collection of notes and information regarding other matters relating to Sal, including the companions associated with it in natural forests.	Kheri Division .	A considerable amount of information has been collected.	Investigations will be continued.	
			FOREST BOTANY.		
11	The pollination of the flowers and distribution of the seed of Sal. Description and illustration of fruit, seed, process of germination and the seedling.	Most of these investigations will be carried out at the Research Institute, short tours being arranged as required.	Not yet begun .	This will be taken up by Mr. Hole on his return from leave.	
12	Study of the conditions favourable and unfavourable for successful germination and early development. This will include among other things the determination of the most suitable physical conditions of the soil.	....	Sal seed has been sown in the experimental garden at Dehra Dun under a number of varying conditions, and the development of the seedlings is being watched.	Study will be continued.	
13	The dying back of seedlings and its causes. How does dying back interfere with the normal development of root and shoot, and does it induce decay in the mature stem?	....	As above . .	As above.	
14	Study of grasses characteristic of Sal forest with special reference to— (*a*) Preparation of descriptions and illustrations, enabling the various species to be easily recognised. (*b*) Their relation to Sal, their competitive action, excretion of poisonous substances, increasing damage by frost, etc. (*c*) Their value as indicators of soil suitable or unsuitable for Sal. (*d*) Their economic value in preventing erosion, as fodder plants and in other ways. (*e*) Effect of fire and grazing upon them. (*f*) Best method of propagating or increasing the proportion of the more valuable species.	....	The results obtained up to date from the study of grasses have been prepared for publication, and a Memoir on the subject is now in the press.	....	
15	Study of the diseases of Sal, whether caused by fungi or otherwise.	Not yet settled .	*Nil.*	Must await return of Mr. Hole.	

Part I.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Forest Research Institute Officers—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			Forest Economy.		
16	Technical properties of wood— (*a*) To carry out experiments with regard to the shearing, crushing and bending strength of wood of seedling and coppice origin, respectively, seasoned and green— (i) Grown in the hills. (ii) Grown in the plains.	Research Institute and Sibpur Engineering College.	Already started .	The investigation will be continued during the year.	The necessary woods are being collected and seasoned.
	(*b*) To test the fissibility of wood of seedling and coppice origin, grown in the hills and plains, seasoned and green— (i) Vertically and tangentially. (ii) Vertically and radially. (iii) Horizontally and tangentially. (iv) Horizontally and radially.	Research Institute, Dehra Dun.	....	The investigation will be started during the year.	Some of the tests have already been carried out: the remainder will be taken in hand during the year.
	(*c*) The time taken for Sal to season under various conditions, and the best methods of seasoning, with special reference to the liability of the timber to crack, warp and shrink.	Do. do. .	Already started .	The investigation will be continued during the year.	
	(*d*) The specific gravity of timber of (i) seedling, (ii) coppice origin, grown at various altitudes and on different soils and aspects.	Do. do. .	Do. do. .	Do. do. .	This will be carried out when the wood collected to carry out the experiments under 16 (*a*) is seasoned.
	(*e*) The relative properties of wood when felled at different times of the year.	And in the field .	....	The investigation will be started during the year.	This will be taken up next touring season.
17	Durability— . . .	Dehra Dun . .	In progress . .	Will be continued during the year.	A considerable amount of information is already available under this head.
	Investigations regarding— (*a*) The life of Sal timber when used (*i*) under cover; (*ii*) in the open; (*iii*) under water.				
	(*b*) The life of Sal sleepers.	....	....	Will be continued during the year.	
	(*c*) The effects of iron fastenings on Sal sleepers.	....	....	Will be started during the year.	Do. do.
	(*d*) The effect of various antiseptic solutions on Sal timber.	....	In progress . .	Will be continued during the year.	

Part I.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Forest Research Institute Officers—concld.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
		Forest Economy—*contd.*			
18	Uses to which the products of Sal can be put— (*a*) Major, *e.g.* timber. (*b*) Minor, *e.g.*, resin, oil, bark tanning extracts and fibre.	....	....	Will be started during the year.	
19	The calorific value of wood when used as (*i*) fuel, (*ii*) charcoal.	....	....	Do. do.	If this portion of the enquiry can be taken up during the year will depend on the Chemist.
20	Supply of and market for Sal—				
	(*a*) Enquiry as to the actual annual outturn of Sal timber— (i) from Government forests; (ii) from private forests, so far as the principal markets are concerned.	....	....	Will be started during the year.	A considerable amount of information has been collected from all the Railway Companies of India.
	(*b*) General note on past and present prices of Sal timber.	....	....	Do. do.	
	(*c*) The available annual supply of Sal sleepers and the past and present prices of the same.	....	In progress . .	Will continue during the year.	Do. do.
	(*d*) Past and present prices of minor products, and possibility of improving the demand.				
	(*e*) Forecast of the Sal trade.	....	Do. do.	Do. do.	This portion of the enquiry is really a summary of data to be collected under heads 20 (*a*), (*b*) and (*c*).
		Forest Zoology.			
21	The study of all insects which cause serious damage to, or which are beneficial to, the Sal tree or its timber.	Western Circle, United Provinces.	This subject has just been taken in hand and work at it throughout this year may be expected.	The same subject will be further investigated.	
		Forest Chemistry.			
22	A special enquiry into Sal bark tanning extracts.	....	....	To be continued.	

Part II.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Research Institute Officers.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			SYLVICULTURE.		
1	The Uniform and Group Methods of Working Forests. Enquiries will be made as to the suitability of these two methods, or modifications of them, in Indian forests.	Forests under these methods of treatment, or which it is proposed to put under them may be visited, *e.g.*, the Chir forests of the United Provinces, the teak forests of Burma (Tharrawaddy and Mohnyin) and the Sal Forests of the Kumaon Division, United Provinces.	The matter has been taken up with the teak forests in Burma.	Investigations into the suitability of the Group and Uniform methods of Working will be continued with special reference to Deodar and Chir pine.	
2	Compilation of statistics of plantations of various species and enquiries, if necessary, into any difficulties met with in the propagation of any particular species, including an enquiry as to the best density to be maintained at different periods. This is in progress for several species, but before anything reliable can be published visits to many of the plantations concerned will be found necessary.	The United Provinces.	Information is in process of collection.	Investigations will be continued.	
3	Investigation into the best methods of cutting and working bamboos. Detailed experiments will be carried out in specially demarcated plots.	Siwalik and Ganges Divisions, United Provinces.	Not yet commenced.	Experiments will be initiated.	
4	The cultivation of trees for the growth of lac experiments, which have been commenced, will be continued with reference to the best methods of (i) preparing trees for the reception of lac, and (2) working prepared trees in rotation.	Siwalik Division, United Provinces.	Investigation in progress.	Will be continued.	
5	Sylvicultural Notes on various species. The collection and collation of statistical and other data regarding the chief Indian trees and types of forest, commencing with Deodar, *Pinus excelsa* and *Pinus longifolia*. The preparation of yield tables and the collection of data for fixing the exploitable size and age as well as the possibility in forests under the different sylvicultural systems.	The United Provinces.	Do. do.	Do. do.	

Part II.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Research Institute Officers—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			Forest Botany.		
6	Study of teak, including the factors favouring the rapid germination of the seed and the development of the young plant; the dying back of seedlings, the mode of origin of coppice shoots, the structure of young and old seedling and coppice plants and pollination of the flowers.	....	Experiments to test the effect of soil, available light, subsoil water level and other factors on the development of teak seedlings are in progress at Dehra Dun. A large quantity of specimens and other material has been collected. A pamphlet on the best season for coppicing teak has been published.	This study will be continued.	
7	Detailed systematic study and description of all forms of forest plants of economic value, when such is required owing to the commercial importance of the species and to the fact that the existing classification and description are unsatisfactory and confusing.	....	Detailed systematic study of the genus *Grewia* was continued but could not be concluded owing to Mr. Hole's absence on leave.	Study of the Grewias will be completed by Mr. Hole on his return from leave.	
8	The study of the fungoid diseases affecting the Blue pine in the Punjab and the *Casuarina* in Madras. Also of the spike disease of sandal in Madras.	....	....	Must await return of Mr. Hole.	
9	An Experimental Botanical Garden will be laid out and maintained in good order.	Dehra Dun, United Provinces.	The garden has been laid out at Chandbagh, and is being maintained.	The garden will be kept up.	
			Forest Economy.		
10	Wood, Bamboo and Grass Pulp— (*a*) Woods, bamboos and grasses suitable for the manufacture of pulp, and the available supply. (*b*) Suitable sites for factories. (*c*) The financial aspect of the business.	India and Burma .	In progress . .		The enquiry concerning wood and bamboos is approaching completion. There remain grasses and other fibrous plants to be dealt with.
11	To keep under observation and encourage the match business in India, which is already started but which is still not firmly established.	Do. do. .	Do. do. .	The enquiry will be continued during the year.	Enquiries are being received from time to time in this connection.
12	Antiseptic Treatment of Woods— To carry out experiments with various antiseptic processes, with special reference to the use of important inferior species for railway sleepers.	India (Dehra Dun especially) also if tests carried out on a large scale as such places where impregnation takes place.	Do. do. .	The investigation will be continued during the year.	The Preliminary Note on this subject is now under preparation.

Part II.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Research Institute Officers—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			Forest Economy—*contd.*		
13	Investigations into the physical properties and seasoning powers of various woods.	Dehra Dun and Sibpur.	....	The investigation will be continued during the year.	A note on the relative strength of plantation and natural grown teak is now in the press.
14	Enquiry as to the use of and the possibility of putting certain gums, resins and oleo resins on the European markets.	....	In progress . .	The enquiry will be continued during the year.	This enquiry will be continued, but at present is not progressing satisfactorily.
15	Investigations to be carried out with regard to the disposal of products obtained from the destructive distillation of woods.	....	....	The enquiry will be started during the year.	
16	Enquiry as to the commercial value of certain oil-seeds.	....	....	The investigation will be conducted during the year.	This enquiry at present consists in attempting to find a market for 5 or 6 of the better known oil-yielding seeds.
17	Investigations regarding woods suitable for—	....	In progress . .	Will be carried out during the year.	
	(*i*) Packing cases.				
	(*ii*) Tea boxes . .	....	Do. do.		
	(*iii*) Opium chests.	....	....	Will be investigated.	
	(*iv*) Paving blocks .	Burma . . .	In progress.		
	(*v*) Railway rolling stock	....	....	Will be started during the year.	
	(*vi*) Carriage building .	....	Not yet started.		
	(*vii*) Harbour construction.	....	Do. do.		
	(*viii*) Other miscellaneous purposes, such as pencils, pipes, hair brushes, fishing rods, veneers, cooperage, etc.	....	In progress . .	Will continue .	Enquiry with regard to some is completed, with regard to others will continue.
18	Description of the woods at present little known in the market—	....	Do. do. .	The investigation will continue during the year.	At present information has been collected regarding six timbers, but as yet the information has not been put together. If it is found that the six species now being dealt with can be disposed of during the year, a further six species will be taken up.
	Yearly a number of woods will be examined and information collected on each species likely to prove of commercial importance, with a view to bringing them to public notice.				
19	Resin tapping of conifers and enquiry into the possibility of improving the present system of distillation.	....	....	....	
20	Enquiry into the subject of useful fibres.	Dehra Dun and probably short tours to collect the fibre.	....	The enquiry will be started during the year.	

Part II.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Research Institute Officers—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			Forest Economy—*concld.*		
21	Enquiry as to the use, if any, of *Strobilanthes* Spp., *e.g.*, the flowers, contain an oil.	....	In progress . .	....	
22	Enquiry as to the suitability of various tan barks, especially Terminalias and Oaks.	....	Do. do.	Will be continued during the year.	The investigation of the chemical side of the enquiry is being carried on by Forest Chemist.
23	Enquiry into the best method of disposing of rosin, including the preparation of a list of the industries in which it is used, with the names of the firms engaged in these industries.	Punjab and United Provinces.	Do. do.	Do. do.	
24	Enquiry into the most profitable method of disposing of lac.	....	....	The enquiry will be initiated during the year.	
			Forest Zoology.		
25	Preparation of a satisfactory reference collection of insects for the Research Institute.	....	We have been working at this all along and hope to bring it to order by June 1911.	This will be kept up and fresh specimens added.	
26	Investigation regarding the lac insect.	....	We have just started this work and will continue to work at it the rest of the year.	This will be further investigated.	
			Forest Chemistry.		
27	Rusa grass oil, to study the causes of differences beween the two varieties, Motia and Sophia, and the possibility of the conversion of Sophia-oil into Motia-oil.	....	In hand . .	To be continued .	In conjunction with the Reporter on Economic Products. Note.—These investigations will be carried out chiefly in the Laboratory of the Imperial Forest Research Institute.
28	The commercial possibilities of the manufacture of Shellac by various processes (in hand).	....	In hand . .	....	
29	Distillation of *Blumea Balsamifera* on a commercial scale (in hand); and of *Cinnamomum glanduliferum.*	....	*Blumea Balsamifera* completed.	*Cinnamomum glanduliferum* will be taken next year.	
30	Oil-yielding forest seeds, their oil value and the determination of the constituents of various oils.	....	In progress . .	To be continued .	In conjunction with the Economist and in communication with the Reporter on Economic Products.
31	Destructive distillation of Indian woods, including the manufacture of Ethyl Alcohol.	....	Small Laboratory trials taken in hand.	....	
32	Manufacture of decolourised Mangrove Extract on a commercial scale.	....	To be completed this year.	....	

Part II.—Statement showing what has already been or is being carried out in the sanctioned periodic programme and what is proposed to be carried out during the forest year 1911-12 by the Research Institute Officers—concld.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	Investigations already in progress or completed.	Investigations proposed to be carried out during the forest year 1911-12.	Remarks.
			Forest Chemistry—*contd.*		
33	Decolourisation and clarification of Indian Colophony (in hand).	....	To be completed this year.		
34	Distillation of miscellaneous fragrant grasses, *e.g.*, khas oil, and the investigation into the properties of the essential oils obtained from them.	....	In progress . .	To be continued.	
35	Examination of the resins of the principal conifers in connection with the production of turpentine.	....	Do. do. .	Do. do.	
36	Investigation regarding the best season for the collection of myrabolans so as to obtain the greatest yield of tannin.	....	Information is being collected.	Do. do.	
37	Enquiry regarding collection and utilization of the milk of *Dichopsis Elliptica*.	....	....	To be taken in hand next year.	

APPENDIX V.

ANNUAL FORM No. 67.

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE.

Summary of Revenue of the different Divisions during 1911-12.

BUDGET HEADS.	President Direction.	Sylviculturist Division.	Forest Botanist Division.	Forest Zoologist Division.	Forest Economist Division.	Forest Chemist. Division.	TOTAL.
1	2	3	4	5	6	7	8
V.—MISCELLANEOUS—	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A P.	Rs. P. P.	Rs. A. P.	Rs. P. P.
b. Refunds	..	12	16	..	470	30	528
c. Other sources	..	..	20	..	137	..	157
Total	..	12	36	..	607	30	685
GRAND TOTAL REVENUE	..	12	36	..	607	30	685

Summary of Expenditure of the different Divisions during 1911-12.

VI.—LIVE-STOCK, STORES, TOOLS AND PLANT—							
c. Purchase of stores, tools and plant	4,526 14 6	65 0 0	617 0 0	195 0 0	111 0 0	442 0 0	5,956 14 6
TOTAL A. VI	4,526 14 6	65 0 0	617 0 0	195 0 0	111 0 0	442 0 0	5,956 14 6
VII—COMMUNICATIONS AND BUILDINGS—							
b. Buildings	2,144 15 9	..	..	..	..	..	2,144 15 9
c. Other works	632 0 2	8 0 0	..	..	..	21 0 0	661 0 2
TOTAL A. VII	2,776 15 11	8 0 0	..	..	..	21 0 0	2,805 15 11
IX.—MISCELLANEOUS—							
b. Other charges	722 1 3	2,008 0 0	929 0 0	408 0 0	7,273 0 0	3,515 0 0	14,855 1 3
TOTAL A. IX	722 1 3	2,008 0 0	929 0 0	408 0 0	7,273 0 0	3,515 0 0	14,855 1 3
TOTAL A.—CONSERVANCY AND WORKS	8,025 15 8	2,081 0 0	1,546 0 0	603 0 0	7,384 0 0	3,978 0 0	23,617 15 8
B.—ESTABLISHMENTS.							
I.—SALARIES—							
a. Conservators	8,520 0 0	..	..	..	..	..	8,520 0 0
b. Superior officers	7,987 1 7	11,700 0 0	12,300 0 0	6,079 0 0	13,827 0 0	12,864 0 0	64,757 1 7
c. Subordinate forest and depôt establishments.	..	2,092 0 0	..	..	..	..	2,092 0 0
d. Office establishments	7,027 0 0	3,380 0 0	4,474 0 0	3,442 0 0	2,494 0 0	2,929 0 0	23,746 0 0
Royal visit bonus	..	39 0 0	44 0 0	46 0 0	35 0 0	36 0 0	200 0 0
e. Deputation and special allowances	2,100 0 0	1,800 0 0	2,040 0 0	..	1,778 0 0	..	7,718 0 0
TOTAL B. I	25,634 1 7	19,011 0 0	18,858 0 0	9,567 0 0	18,134 0 0	15,829 0 0	1,07,033 1 7
II.—TRAVELLING ALLOWANCES—							
b. Superior officers	33 0 0	2,208 0 0	1,152 0 0	1,395 0 0	2,231 0 0	81 0 0	7,100 0 0
c. Subordinate forest and depôt establishments.	..	302 0 0	..	..	..	..	302 0 0
d. Office establishments	..	480 0 0	216 0 0	242 0 0	549 0 0	8 0 0	1,495 0 0
TOTAL B. II	33 0 0	2,990 0 0	1,368 0 0	1,637 0 0	2,780 0 0	89 0 0	8,897 0 0
III.—CONTINGENCIES—							
a. Stationery	..	24 0 0	5 0 0	32 0 0	14 0 0	49 0 0	124 0 0
b. Carriage of tents and records	..	772 0 0	145 0 0	78 0 0	209 0 0	..	1,204 0 0
c. Rents, rates and taxes	22 10 8	..	60 0 0	..	..	1,879 0 0	1,961 10 8
e. Official postage	200 0 0	200 0 0	195 0 0	217 0 0	408 0 0	61 0 0	1,281 0 0
f. Sundries	7,936 11 2	577 0 0	2,046 0 0	1,568 0 0	948 0 0	1,231 0 0	14,306 11 2
TOTAL B. III	8,159 5 10	1,573 0 0	2,451 0 0	1,895 0 0	1,579 0 0	3,220 0 0	18,877 5 10
TOTAL B.—ESTABLISHMENTS	33,826 7 5	23,574 0 0	22,677 0 0	13,099 0 0	22,493 0 0	19,138 0 0	1,34,807 7 5
GRAND TOTAL OF EXPENDITURE	41,852 7 1	25,655 0 0	24,223 0 0	13,702 0 0	29,877 0 0	23,116 0 0	1,58,425 7 1
SURPLUS OR DEFICIT	41,852 7 1	25,643 0 0	24,187 0 0	13,702 0 0	29,270 0 0	23,086 0 0	1,57,740 7 1

H. B. RAU,
Deputy Comptroller, India Treasuries.

Certified that the totals of this form as printed in the Forest College and Forest Research Institute Report for 1911-12 when added together agree with those entered in the forms for the combined office as supplied by the Comptroller, India Treasuries, under Article 271 (II) of the Forest Department Code.

CALCUTTA ;
The 21st August 1912.

L. MERCER,
President, Forest Research Institute and College.

APPENDIX VI.

FORM No. 68.—[PRESCRIBED.]

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE.

Account Current for the Forest year 1911-12.

RECEIPTS.	President.	Sylviculturist.	Botanist.	Economist.	Zoologist.	Chemist.	TOTAL.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
CASH BALANCE	..	207 15 8	474 4 0	..	112 5 8	50 0 10	844 10 2
VIII.—ASSESSED TAXES—							
Income Tax—deductions from salaries	..	317 11 9	346 10 3	355 11 10	158 9 11	348 13 11	1,527 9 8
REVENUE DURING THE FOREST YEAR	..	12 2 8	35 10 0	607 8 0	..	30 0 0	685 4 8
FOREST ADVANCES	..	3,834 8 11	2,458 0 1	1,076 7 9	203 7 5	91 7 11	7,659 0 1
SERVICE FUNDS—							
Uncovenanted Service Family Pension Fund, Bengal.	..	..	348 4 0	..	..	..	348 4 0
SAVINGS BANK DEPOSITS—							
Bank Account— General Provident Fund	..	1,279 11 0	2,268 12 0	1,050 0 0	730 2 0	..	5,328 9 0
Forest officers Provident Fund	..	..	..	542 11 2	..	..	542 11 2
CASH REMITTANCES—LOCAL—FOREST REMITANCES—							
Forest cheques drawn	1,105 2 1	127 9 6	967 15 3	278 7 0	835 4 2	300 10 4	3,615 0 4
EXCHANGE ACCOUNT WITH OTHER GOVERNMENTS—							
Account between India and Eastern Bengal and Assam— III.—Items adjustable by India	..	..	..	550 0 0	..	..	550 0 0
Account between India and Bengal— III.—Items adjustable by India	..	..	48 11 3	134 12 0	..	14 13 3	198 4 6
Account between India and United Provinces of Agra and Oudh— III.—Items adjustable by India	38,656 10 0	23,960 14 8	19,870 4 9	27,472 5 1	12,614 12 3	22,369 14 6	1,44,944 13 3
Account between India and Bombay— III.—Items adjustable by India	..	59 13 9	..	..	..	34 7 7	94 5 4
INTER-DEPARTMENTAL TRANSFERS—							
Military Supply Department	..	22 0 6	..	10 10 11	34 11 3	16 12 0	84 2 8
Telegraph Department	..	..	135 0 0	..	..	..	135 0 0
Post Office Department	..	.. ..	31 8 0	..	..	..	31 8 0
Civil Departments	2,090 11 0	13 7 0	431 5 0	15 9 4	..	..	2,551 0 4
GRAND TOTAL	41,852 7 1	29,835 15 5	27,411 4 7	32,094 3 1	14,689 4 8	23,257 0 4	1,69,140 3 2
PAYMENTS.							
I.—REFUNDS AND DRAWBACKS	..	..	15 13 0	..	..	..	15 13 0
EXPENDITURE DURING THE FOREST YEAR.	41,852 7 1	25,654 12 11	24,223 6 8	29,876 10 2	13,701 10 4	23,116 2 5	1,58,425 1 7
FOREST ADVANCES	..	4,156 7 5	2,135 10 11	1,608 5 10	260 2 5	65 0 0	8,225 10 7
SUSPENSE ACCOUNT	..	..	0 6 0	..	..	..	0 6 0
SAVINGS BANK DEPOSITS—							
Bank Account— General Provident Fund	..	..	1,000 0 0	..	..	..	1,000 0 0
CASH REMITTANCES—LOCAL—FOREST REMITTANCES—							
Remittances to Treasuries	..	..	0 6 0	..	..	..	0 6 0
EXCHANGE ACCOUNT WITH OTHER GOVERNMENTS—							
Account between India and Bengal— III.—Items adjustable by India	..	..	..	1 11 1	..	..	1 11 1
Account between India and United Provinces of Agra and Oudh— III.—Items adjustable by India	..	24 11 1	35 10 0	..	..	30 0 0	90 5 1
Account between India and Bombay— III.—Items adjustable by India	..	..	..	607 8 0	..	..	607 8 0
INTER-DEPARTMENTAL-TRANSFERS—							
CASH BALANCE	..	..	..	..	727 7 11	45 13 11	773 5 10
GRAND TOTAL	41,852 7 1	29,835 15 5	27,411 4 7	32,094 3 1	14,689 4 8	23,257 0 4	1,69,140 3 2

H. B. RAU,
Deputy Comptroller, India Treasuries.

Certified that the totals of this form as printed in the Forest College and Forest Research Institute Reports for 1911-12 when added together agree with those entered in the forms of the Combined Office as supplied by the Comptroller, India Treasuries, under Article 271 (ii) of the Forest Department Code.

CALCUTTA ;
The 23rd August 1912.

L. MERCER,
President, Forest Research Institute and College.

APPENDIX VII.

ANNUAL FORM No. 70.

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE.

Outstandings and Liabilities on account of Contractors and Disbursers of the Forest Research Institute for the Forest year 1911-12.

Division.	DEPARTMENT DEBTOR.			DEPARTMENT CREDITOR.			BALANCE DUE.
	At commencement of Forest year.	Recoveries in cash and value of supplies and work done during the Forest year 1911-12.	At close of Forest year 1911-12.	At commencement of Forest year 1911-12.	Payments made during Forest year 1911-12.	At close of Forest year 1911-12.	To Department (Outstandings).
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Sylviculturist	.. .. ..	3,834 8 11	3,834 8 11	133 15 3	4,156 7 5	4,290 6 8	455 13 9
Forest Botanist	.. .. ..	2,453 0 1	2,453 0 1	324 12 5	2,135 10 11	2,460 7 4	7 7 3
Forest Zoologist	.. .. ..	203 7 5	203 7 5	....	260 2 5	260 2 5	56 11 0
Forest Economist	.. .. ..	1,076 7 9	1,076 7 9	66 15 5	1,608 5 10	1,675 5 3	598 13 6
Forest Chemist	.. .. ..	91 7 11	91 7 11	26 7 11	65 0 0	91 7 11	....
Total	.. .. ..	7,659 0 1	7,659 0 1	552 3 0	8,225 10 7	8,777 13 7	1,118 13 6

H. B. RAU,

Deputy Comptroller, India Treasuries.

CALCUTTA;
The 23rd August 1912.

CALCUTTA : PRINTED BY SUPDT. GOVT. PRINTING, INDIA, 8, HASTINGS STREET.

PROGRESS REPORT

OF THE

FOREST RESEARCH INSTITUTE

For the year 1912-13

(Forest Year)

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1913

[PRESCRIBED MAXIMUM LIMIT OF REPORT—10 PAGES.]

Progress Report of the Forest Research Institute for the Forest Year 1912-13.

CHAPTER I.

ADMINISTRATION.

MR. L. MERCER, C.I.E., Conservator of Forests, held the post of President throughout the year until the afternoon of the 13th April 1913, when he proceeded on leave, the writer being appointed to act for him.

The following statement gives the names of the officers who held charge of the various branches :—

Branch of the Forest Research Institute.	Dates.		Name of Officer in charge of Branch.
	From	To	
Sylviculture .	1st July 1912 .	13th April 1913 .	Mr. R. S. Troup, F.C.H., Deputy Conservator of Forests.
	14th April 1913 .	30th June 1913 .	Mr. R. E. Marsden, Deputy Conservator of Forests.
Forest Botany .	1st July 1912 .	14th April 1913 .	Mr. R. S. Hole, F.C.H., F.L.S., F.E.S., Deputy Conservator of Forests.
	15th April 1913 .	30th June 1913 .	Mr. R. N. Parker, F.C.H., Deputy Conservator of Forests.
Forest Economy .	1st July 1912 .	30th June 1913 .	Mr. R. S. Pearson, F.L.S., Deputy Conservator of Forests.
Forest Zoology .	1st July 1912 .	27th February 1913.	Dr. A. D. Imms, B.A., B.Sc., D.Sc.
	28th February 1913.	30th June 1913 .	Mr. N. C. Chatterjee, B.Sc.
Forest Chemistry .	1st July 1912 .	30th June 1913 .	Mr. Puran Singh, F.C.S.

CHAPTER II.

WORK OF THE INSTITUTE.

SECTION 1.—TUITION.

The third year's course having been abolished, and the newly-inaugurated Provincial Service Course commencing only on November 1st, Research Officers delivered no lectures during the year with the exception of the Botanist, who gave a course of botanical lectures to the Provincial Class in November-December and of the Chemist, who gave a short course of lectures to the Ranger Class. The principle has been clearly laid down in the past that, both in the interests of higher education and for the benefit of their own work, it is advisable for Research Officers to give advanced instruction in their respective subjects. This participation in educational work on the part of Research Officers is also rendered necessary by the fact that there is only one instructor in charge of each Provincial Service Class who cannot possibly deal adequately with all the subjects in the curriculum. While recognising the justice of this general principle, however, it is most necessary to see that it is not allowed to unduly interfere with research work proper. The importance of this point has not yet been fully realised owing to the fact that up to date only one Provincial Service Class has been in residence at the College, and that the course for this class has been reduced to 20 months instead of the full 24 months. From the year 1914, however, when the first full course of 24 months' instruction in each subject will be in operation, and when there will be two classes in residence at the same time, the full effect of this educational work will make itself felt.

Under existing conditions of staff and curriculum, for instance, the Botanist will, in 1914 and subsequent years, have no time for research work during 5 months of the year, when he will be fully engaged with educational duties; and it must also be remembered that inability to record observations, or to do certain work on a particular date, may render abortive the research work of an entire year or even longer period. This applies more or less to all Research Officers and the only remedy is to supply Research Officers with assistants who will be able—(1) to undertake the routine duty of collecting and preparing diagrams, material and apparatus required for the lectures and other work which it is false economy to give to a highly-paid expert, and (2) to temporarily relieve Research Officers of educational work for short periods when urgent research work renders this necessary.

SECTION II.—Investigations and Research.

The principal work of the year in the various branches is summarised below :—

(a) *Working Plans and Sylviculture.*

Work referring to Sal (Shorea robusta).

The working plan for the Thano *Sal* forest having been prepared by the Sylviculturist in 1910 with the object of converting experimentally this irregular *Sal* forest into a regular *Sal* forest, fellings and other operations were carried out in the area as prescribed by the Working Plan ; it will be a long time, however, before the success of the experiment can be sufficiently estimated to allow of further extension of the method adopted.

Two plots were laid out at Ramnagar with the object of testing the effect upon natural reproduction of removing one-half to two-thirds of the crop ; the influence of frost was also under investigation. The plots laid out for the same purpose in former years were maintained and several experiments were instituted at Dehra Dun in the sylvicultural gardens to test the results of different degrees of light, shade and moisture.

Experiments made at Dehra Dun indicate that the seed of the *Sal* should be collected while still on the tree, and from fairly mature trees. The best means of preserving the seed are under investigation. Experiments in line sowing, in trench and mound sowing and in sowing with field crops and with nurses are in progress.

Since the publication last year of a Forest pamphlet on the seed of the *Sal* and its source, experiments continue to be conducted in the sylvicultural gardens, at Dehra Dun. Endeavours are being made to trace the occurrence of seed years with fair success.

Plots have been laid out for testing the best method of coppicing *Sal* and observations will be made at the the end of this rains. Owing to the severe frost of 1903-4, it is hard to obtain seed from coppice *Sal*.

Twenty-one permanent plots and one temporary sample plot were laid out in *Sal* forest, 8 in the Siwalik Division, 7 in Ramnagar, and 12 in Gorakhpur, with the object of determining the increment of *Sal* in girth, height, and volume. Owing to the deputation of Mr. Troup to Simla as Assistant Inspector-General of Forests all of this work had to be done by the assistant to Sylviculturist. These plots averaged half-an-acre in area.

In the sample plots thinnings are made regularly, and the results noted with the object of ascertaining the optimum density. Thus of 21 sample plots, 9 were thinned and the volume of produce removed was noted, the degree of severity of the thinning varying with the different conditions of the sample plots.

A Bulletin was published on the Causes and Effects of the Drought of 1907 and 1908 in the *Sal* forests of the United Provinces. This establishes the fact that the subsoil is probably the deciding factor in maintaining or failing to support the growth of *Sal* in time of drought. The drying up of the trees was due primarily to the presence in the subsoil of a thick layer of pure sand. When the drought came and the water-level sank, the sandy subsoil was unable to retain a sufficiency of moisture to keep the trees alive, whereas a clayey subsoil always retained a percentage of moisture above the minimum required to support the forest growth.

Numerous notes and photographs illustrating the sylviculture of the *Sal* have been taken during the year and the types of *Sal* forest are beginning to be distinguished.

Work relating to other Species.

The Uniform and Group Methods of working forests were studied in Rawalpindi and Bashahr Divisions with reference to *Pinus longifolia* and *Cedrus Deodara*. In the case of the former species, the introduction of an even-aged system appears to be desirable in those divisions where an irregular method has obtained ; the deciding factor in the selection of a sylvicultural system for deodar seems to be the effect the chosen system will exercise upon a satisfactory preparation of the soil, not for a germinating bed but for the permanent accommodation of the young plant.

A record was published giving statistics for *Eucalyptus globulus* plantations and showing some astonishing results in the rate of growth. A 5-year-old coppice wood had a mean annual increment of 815 cub. ft. per acre, and a 30-year-old high forest 527 cub. ft.

The figures collected for the teak plantations in Nilambur are not yet sufficiently numerous to be worth publication. A wood 11 years old had a mean annual increment per acre of 117 cub. ft., 20 years old 96 cub. ft., and 50 years old 55 cub. ft.

The *lac* experiment at Ranipur was continued. In July and October 1912 opportunity was taken of the swarming to make further endeavours to propagate the insect. Lopping was also experimentally continued. As a result of the year's working, only some 3 ounces of *lac* were obtained, although about 2,000 sticks of seed *lac* were used for propagation in October 1912. The experiment will soon be discontinued, as the locality for some reason appears to be unsuitable in view of the fact that good *lac* is obtained at Bishanpur, some 6

miles distant. Propagation experiments have now been in progress for 3 years, that is 6 times altogether have sticks of seed *lac* been tied to trees not yet infected with practically no result.

Statistics of the rate of growth of *Cedrus Deodara, Pinus excelsa, Pinus longifolia, Dalbergia Sissoo* and *Quercus dilatata* were collected in considerable volume, and 42 permanently demarcated sample plots were laid out in the Jaunsar, Bashahr and Siwalik Divisions together with 7 permanently demarcated experimental plots for *Pinus longifolia* in Rawalpindi. In addition, for *Cedrus Deodara* 2 temporary plots in Chakrata and 6 in Bashahr were measured up, for *Pinus excelsa* 2 temporary plots in Chakrata, for *Pinus longifolia* 2 temporary plots in Chakrata and 7 in Rawalpindi, for *Dalbergia Sissoo* 1 temporary plot in Gorakhpur.

The sylvicultural characters of the conifers and Himalayan oaks are being specially studied, and much information has been collected.

(b) *Forest Botany.*

Oecology of Sal.—Experiments carried out during the year by the Forest Botanist in growing *Sal* seedlings (*a*) *in situ* in typical local grasslands, and (*b*) at Dehra Dun in large flower pots in soil collected from the same grasslands have corroborated the fact mentioned in previous reports that the dominant species of grass is an accurate indicator of the local conditions of soil and of the suitability or otherwise of the area occupied by these grasses for the growth of different forest trees. The work done up to date shows that for the successful growth of *Sal* seedlings the soil must be well aerated and must at the same time be capable of retaining not less than 10 per cent. of moisture throughout the hot season. In a badly aerated soil the percentage of germination of *Sal* is lower and the percentage of deaths during the rains is higher than in a well aerated soil. In addition to this, the average length of root of one-year-old *Sal* seedlings is 12″ and 30″ in badly and well aerated soils, respectively. Thus the former plants are also more subject to the injurious action of drought, seeing that their roots are situated in the upper layer of soil which dries out rapidly in the hot season. An interesting fact brought out in the experiments is that by simple mechanical pressure even when the soil is practically dry such as would be caused by the tread of grazing animals a soil known to be suitable for the growth of *Sal* can be rendered totally unsuitable on account of its bad aeration.

An important point investigated during the year was that of the heavy mortality of *Sal* seedlings which usually occurs in the local *Sal* forests during the rains, in July-August. The experiments carried out clearly shewed that the responsible factor was not shade, *i.e.*, an insufficient intensity of light. The light intensity in the forests where the mortality ranged from 80-90 per cent. of deaths was 0·02 to 0·05. Under artificial shades, on the other hand, *Sal* seedlings have been grown successfully with a light intensity as low as 0·007, the mortality during the rains being only 20 per cent. So far as the work has gone at present it indicates that the dominant factor here responsible is bad soil aeration which is brought about chiefly by (*a*) the shade in the forest preventing free air circulation and thus decreasing the evaporation of water from the soil, and (*b*) a high percentage of humus in the surface soil which greatly increases its capacity for holding water. A set of experiments has been designed which should further elucidate this point next year, and it has been considered advisable to defer publication until these results are available.

Forest Grasses.—The study of the species mentioned in last year's report was continued while the work undertaken in collaboration with Mr. Raitt on those species likely to be valuable for paper pulp was completed, and the results of the latter are now in the press. The following widely distributed and gregarious species have all been found to constitute a first-class material for the manufacture of paper pulp, and they can all be treated either separately or in mixture without reducing the value of the product :—

Saccharum spontaneum, Linn.	*Anthistiria gigantea*, Cav.
,, *arundinaceum*, Retz.	*Arundo Donax*, Linn.
,, *Munja*, Roxb.	*Phragmites Karka*, Trin.
,, *Narenga*, Wall.	

The following species, although somewhat inferior in quality and strength of fibre to the above, have been found to be admissible in moderate quantity with them without material prejudice to the yield and quality of the pulp :—

Saccharum fuscum, Roxb.	*Andropogon Nardus*, Linn.
Andropogon intermedius, Br.	*Erianthus Ravennae*, Beauv.
Vetiveria zizanioides, Stapf.	

A negative result of considerable importance is that the very common *Andropogon contortus*, Linn, the well-known Spear Grass of the plains, is of no value and is quite inadmissible in mixture. It has been found that the maximum yield of cellulose is obtained if the grasses are cropped when flowering, and, as the culms of some of the species require more than one year to attain maturity and flower, this means that they must be worked on a rotation. One species, *viz.*, *Saccharum arundinaceum*, Retz, the culms of which require 3 or 4 years to attain

maturity, has been found to give an average annual yield of 14 tons of dry material per acre per annum which is believed to be the highest yield of any pulp-yielding species. (*Hedychium coronarium* has been recently reported to give 10 tons per acre per annum which is apparently the next highest yield.) Another of the species dealt with (*Anthistiria gigantea*) has been found to yield a pulp of quite exceptionally high quality.

At the request of the Inspector-General of Forests a Note was prepared on the chief fodder grasses of Indian forests which was put before the Board of Forestry for consideration and also published in the *Indian Forester*. In this paper the necessity of at first concentrating attention on dominant species was emphasized and the points regarding which further information is required were indicated. It is hoped that local officers will help in this enquiry.

Prominent attention was drawn to the value of the exotic *Prosopis juliflora* during the year which is likely to prove a most valuable species for the afforestation of arid tracts.

The new species *Albizzia Lathamii* was published during the year.

A paper on the Indian species of *Xylia* was contributed to the *Indian Forester* during the year, pointing out the present position of the inquiry and the specimens still required to finally settle the identification of the different forms.

Identification of Specimens.—The number of specimens identified during the year for Forest Officers and others amounted to 294 as against 246 of last year and 50 of the year before. This work is thus steadily increasing.

Local Floras and Lists.—The Botanist prepared a detailed Note on the preparation of descriptive lists in the various provinces for the consideration of the Board of Forestry which met at Dehra Dun in March. The Board passed the following resolutions upon this note :—

(1) That detailed Forest Floras are useful for purposes of reference, and that their ultimate publication is an object which should be kept steadily in view.

(2) That the preparation of detailed floras is not of such urgent importance at the present time as is the preparation of descriptive lists.

(3) That the scope and general character of the descriptive lists, as detailed in the Note, are generally suitable.

(4) That the preparation of descriptive lists should be undertaken in the various provinces as soon as circumstances permit.

This resolution was accepted by the Government of India after the close of the year, who "trust that Local Governments will now undertake the preparation of descriptive lists on the lines referred to."

There is thus reason to believe that this important work will now be systematically taken in hand.

(c) *Forest Economy.*

The Sal Enquiry.—The enquiry into the technical properties, uses, outturn, and prices of *Sal* timber was completed during the year under report, and a Memoir was prepared dealing with the information collected and the results obtained from the experiments which has since been sent to the press. The only points not dealt with in the Memoir are those which refer to the best season of felling *Sal* trees and those relating to the contraction of the timber while seasoning. As the experiments carried out in this connection will not be completed for several years, it was deemed advisable to publish the large amount of data already collected at once and to prepare separate reports on the results of the remaining experiments at a later date.

(*a*) *Wood, Bamboo and Grass Pulp.*—The report as to the value of *bamboos* for paper pulp has been completed by the publication of a Record on the subject. During the year a considerable amount of work has been done in connection with arranging the terms of leases to exploit bamboos on the applications submitted by various firms. One firm has been granted a lease in Bengal, another has applied for a lease to exploit bamboos from forests situated in two divisions of the Pegu Circle of Burma, and a third has applied for a similar lease in Arakan.

An experiment of sending 10,000 *Melocanna bambusioides* bamboos from Arakan to the Titaghur Paper Mills for testing was carried out at the instigation of Mr. Walker, the Divisional Forest Officer, Arakan. The pulp obtained from the original boilings showed it to contain fine black fibres. After further experiments had been carried out with the 10,000 bamboos mentioned above, however, this difficulty was overcome, though the pulp was still inferior to that obtained from *Bambusa polymorpha* and *Cephalostachyum pergracile* owing to the high percentage of bleaching powder which it absorbed.

(*b*) *Grass Pulps.*—The most important work done in this connection has been carried out by Messrs. Hole and Raitt. The subject is an important one, and arrangements are being made to send a consignment of *Anthistiria gigantea* grass to the Bengal Paper Mills for testing on a commercial scale.

(*c*) The *wood pulp* enquiry has been in abeyance during the year owing chiefly to the fact that, according to the information available, although suitable broad-leaf species occur

in fairly large quantities, their scattered distribution renders the cost of their extraction prohibitive. A lessee applied for a concession to extract Spruce and Silver fir from the Punjab forests with a view to converting the timber into mechanical pulp and all possible information was supplied to him. Information, however, is not available as to whether the enterprise is progressing or not.

The Match Industry.—The match business is now fairly well established in India and Burma. Many enquiries were submitted to the Economist's office regarding suitable woods and the best method of dealing with the discolouration of the timber before conversion. The Economist also met, in Rangoon, the Manager of the Mandalay Match Factory Co., which has recently been started, and discussed with him the question of testing possible timbers, etc.

Antiseptic Treatment of Timber.—This enquiry was vigorously prosecuted during the year, the work falling naturally under two separate heads : (i) Laboratory experiments and (ii) Experiments on a large scale.

Laboratory experiments.—Up to date 639 treated and untreated specimens have been laid down and kept under observation, of which 120 were added during the year under report. Of the total number 147 are devoted to a test of the Powell process, the remainder being laid down in connection with 19 different antiseptic solutions. The first lot of specimens was laid down in April 1909, so that the results available up to date already indicate the most suitable antiseptic solutions with which to carry on the work.

Experiments on a large scale.—These experiments were started four years ago. The first batch of sleepers was treated by the Powell process, about 3,000 in all, of five species of timber. They were laid down two years ago, and those in the Quetta, Sukkur, Lucknow, and Lhaksar sections of the lines were inspected during the year by the writer and found to be in excellent order.

Another batch of about 2,000 sleepers were treated with *Avenarius Carbolineum* oil last year, and most of these have been laid down this year, some of the treated Dipterocarps being inspected by Mr. Pearson last January near Pyinmana.

About 1,400 sleepers were treated during the year with Chloride of Zinc and Green-oil and 30 with an "Atlas" solution and *Carbolineum* oil. The treatment was carried out in Pyinmana, Jagadhri, and Betul by the Economist. Arrangements are being made to hand these sleepers over to the various railway companies. The last lot of sleepers to be treated with *Solignum*, in connection with these experiments, will be dealt with during 1913-1914.

These experiments have attracted the attention of the Railway Board and the public, and it is thought that the efforts which have been made by the Forest Department in this connection may lead to definite results in the near future.

Investigation into the seasoning power and Mechanical and Physical Properties of Timber.—(*i*) The enquiry as to the relative strength of natural and plantation-grown teak in Burma was completed and a Bulletin published on the subject.

(*ii*) A Note was also published on the properties of Toon wood (*Cedrela Toona*) while seasoning.

(*iii*) The experiments carried out to ascertain the value of "Ligno" to prevent timber from splitting while seasoning were brought to a conclusion and a Note published on the subject.

(*iv*) An experiment was in progress with the same object in connection with *Sal* timber, the final results of which are not yet available.

(*v*) Extensive experiments as to the best time during which to fell *Sal* trees and others and to ascertain the rate of seasoning of the timber were carried out during the year.

(*vi*) At the request of the Forest Botanist various species of *Grewia* logs were laid down to season, the timber of which will afterwards be tested for its mechanical strength.

Gums, Resins and Oleo-resins.—(*i*) A considerable amount of attention has been paid to the possibility of utilizing *Boswellia serrata* gum-resin. Experiments were carried out in order to ascertain the best methods of tapping the trees. These experiments were commenced last year during the hot weather, very indifferent results being obtained, and it was, therefore, considered necessary to try tapping in the cold weather. A series of experiments were undertaken by the Divisional Forest Officers of Nimar and Melghat, in the Central Provinces, by the Conservators of Forests in Gwalior and Kotah States and by the Forest Economist in the Siwaliks. It was found by all these officers in their various experiments that some trees yielded copious gum-resin, while others yielded very little, the size and age of the tree having little to do with the yield obtained. It is proposed to carry out further experiments in this connection during the next cold weather in the Central Provinces in order to ascertain the best rotation for tapping with special reference to the power of the tree to heal the wound caused by tapping it. The gum-resin of this tree was distilled by the Forest Chemist, turpentine, rosin, gum and an essential oil being prepared. These products were submitted to firms for valuation, and the preliminary reports received justify further investigation being made.

(*ii*) A good deal of work was done in connection with the distillation of *Pinus longifolia* resin, resulting in the remodelling of the Government Rosin and Turpentine Factory at Bhowali.

(*iii*) The question of introducing into Europe the natural varnish obtained from *Melanorrhoea usitata* was under investigation; many firms have enquired about this commodity. This subject is still under investigation.

Enquiry as to the commercial value of certain Oilseeds.—This enquiry was held in abeyance pending the results of valuation surveys being made in the Central Provinces to ascertain the possible outturn of *Schleichera trijuga* seeds.

It is understood that the attempts made to bring *Taraktogenos Kurzii* and *Mesua ferrea* seeds into the market have led to leases being granted to a firm in Chittagong for the right to collect these seeds in Assam and Burma.

Wood distillation.—Correspondence has been going on with the Conservator of Forests, Western Circle, United Provinces, with the object of determining whether the twisted pine of the Airadeo forests can be utilised for the production of turpentine, rosin, and charcoal by destructive distillation. Arrangements are being made with an American firm to test a sample of this timber which is to be sent to them. The forests themselves were inspected by the Economist in company with the Conservator and Divisional Forest Officer.

Wood Fibres.—Samples of fibre of *Bauhinia Vahlii, Helicteres Isora, Sterculia villosa, Trema orientalis, Urena lobata* and *Calotropis procera* were submitted to a home firm for valuation, some of the reports being encouraging. Enquiry was also made, in this connection, as to outturn and prices; while two Forest Officers under the direction of the Conservator of Forests, Sind, carried out extremely interesting experiments in order to ascertain the best methods of collecting and separating *Calotropis* fibre.

Tea Boxes.—A tour was made last year to enquire into the tea-box industry in Assam. One of the chief difficulties with which the tea-box sawmill managers have to contend is the impossibility of storing shooks against demand owing to the deterioration of the timber and its liability to be attacked by borers. To overcome this difficulty experiments were carried out during the year at the Forest Research Institute by treating the shooks with Chloride of Zinc, Alum and Copper Sulphate solutions. It was found that the treated shooks affected the tea-lead with which they came in contact; this was overcome by either applying a coat of varnish to the inside of the shook or by placing brown paper between the lead and the shook or by using silverised paper instead of tea-lead. A further experiment is now being carried out in this connection with the co-operation of Mr. Blair, of the Surma Valley Sawmills and an Assam tea planter, by which tea packed in treated shooks is being sent to Europe in order to ascertain whether the tea is affected in any way. The other part of the enquiry consisted in placing treated shooks in positions where they were liable to be attacked by insects. They have now been under observation for a year, and up to date they have not been damaged in any way.

Railway Rolling Stock.—Logs of *Terminalia tomentosa* timber were sent from the United Provinces to the Wagon and Carriage Superintendent, Ajmer, for trial as to their value and utility for the bottom of ballast wagons. The report on the subject is awaited.

Paving Blocks.—A preliminary enquiry has been started in this connection, the Chief Engineers of the Bombay and Calcutta Municipalities having agreed to participate in the work.

Venesta Boxes.—Several timbers were sent home from Assam, Burma, and the Andamans to the Venesta Co., in England to be cut into veneers and tested as to their value for three-ply boards. The report on the Assam species, *i.e.*, *Shorea assamica, Dipterocarpus pilosus* and *Terminalia myriocarpa* was unfavourable, the grain of the wood being too coarse, while they contained objectionable gums and resins. The report on the other species is awaited.

Some *Bombax malabaricum* veneers were procured through the good offices of Mr. Rossner, match expert, and were sent to the Manager of the Mekla Nudi Sawmills in Assam, who prepared three-ply boxes from them, which proved highly satisfactory, the only drawback being that the glue with which they were held together proved not strong enough for the purpose.

Tan Barks.—The enquiry regarding the possibility of utilizing certain tan barks for preparing tan extracts was continued, and a good deal of information was collected as to outturn, the Economist having carried out experiments in the Siwaliks to determine the yield of dry bark from *Terminalia tomentosa* and *Shorea robusta* trees of different girths. In the Central Provinces and in Sind the Conservators carried out extensive experiments to ascertain the yield of the bark per acre of *Acacia arabica*, 30 tons of this bark having since been sent to the Raneegunge Tan Extract Factory for testing. The Divisional Forest Officer, Arakan, carried out similar experiments in Mangrove forests and felled a sample plot to ascertain the yield and cost of extraction of the bark per acre.

(d) *Forest Chemistry.*

Distillation of Cinnamomum glanduliferum, and an enquiry into the value of Products obtained.—It gave no camphor as reported but yielded a volatile oil whose composition was studied at the Imperial Institute and published in the *Journal* of the Chemical Society. The enquiry was abandoned.

The determination of the Constants and Constituents of various Oils from Forest Seeds.—A Note on the oil value of different Forest seeds has been published in the *Indian Forester*,

but the determination of the constants and constituents was postponed because of the publication of Agricultural Ledger No. 5 in 1912 by Mr. D. Hooper, of Calcutta.

Examination of the Resins of principal conifers in connection with the production of Turpentine.—This enquiry has been completed. A Note on the subject is in Press.

Investigation regarding the tannin value of Burmese Myrabolans as compared with the Indian.—This enquiry has been completed. It is remarkable that the tannin value of the Burmese Myrabolans, said to be the fruits of *Terminalia Chebula*, is less than half of that of the fruits of the same species growing in India. It is, therefore, doubtful if the Burma species is botanically identical with the one growing in India. The Forest Botanist has been requested to go into the question. On the receipt of his report as to the identity or otherwise of the two species, the results of the tannin value of about 23 samples from Burma will be published for general information.

Enquiry regarding the collection and utilization of the Milk of Dichopsis elliptica.—This enquiry has been completed, and a short note on its composition has been sent to the *Indian Forester* for publication. It yields an inferior kind of Gutta.

Enquiry as to the suitability of various barks for tannin extracts, especially Terminalias and Oaks.—Two short notes, one on Oak barks as a material for the manufacture of tannin extracts and the other on *Terminalia tomentosa* bark have been sent to the *Indian Forester* for publication. It is shown therein that there is no likelihood of Oak barks being utilized for tannin extracts in the near future, firstly because of their being inaccessible to the market at remunerative rates and secondly on account of the abundance of better and cheaper tanning materials in this country. As regards *Terminalia tomentosa* bark attempts made in the past to utilize it as a material for the manufacture of tannin extract have given negative results, but the enquiry is still kept open at the Institute for further development.

Sal Soil analysis in conjunction with the Sylviculturist and Forest Botanist.—The mechanical and chemical analysis of ten different samples of *Sal* soils were completed during the year in conjunction with the Forest Botanist. Six samples from the Divisional Forest Officer, Jalpaiguri Division, and 24 samples from the Divisional Forest Officer, Mandla Division, were also analysed.

The effect of Age on Tanning Materials.—This enquiry is still in progress, the results so far obtained show that once the tanning materials are dry and well stored, there is little variation in their tannin value, except in the case of the wood of *Acacia Catechu*, in which case deterioration is due to the process of 'weathering' of the wood.

The utilization of the Gum Resins of Boswellia serrata.—The resin of *Boswellia serrata* has been examined. The preliminary results so far obtained indicate the possibility of distilling from it a good quality of turpentine oil and a resin probably suitable for varnishes and as an adulterant of shellac. The gum contained in the resin seems to be of little value, but no final opinion can be formed until samples are prepared and put on the market in fairly large quantities. A still especially designed for distilling *Boswellia* resin has been ordered and the enquiry will be continued so soon as the still is available.

Analysis of Sundri Fruits.—Sundri fruits were received from the Divisional Forest Officer, Sunderbans, for analysis through the Forest Economist. They are rich in starch, and further enquiry as to the possible uses to which they can be put will be continued next year.

Cultivation of Forest Drugs in Indian Forests.—With the permission of the President the Forest Chemist drew up a note on this subject showing the extensive trade that is being carried on in this country in forest drugs. This note was published in the *Indian Forester*, Vol. XXXIX, No. 3.

Ceará Rubber from Coorg.—At the request of Mr. Raitt a sample of Ceara rubber from Coorg was examined with the object of comparing its composition with that of high grade Ceara rubber. It contained 11·24% of resins and could not therefore be classed with first grade Ceylon rubber.

Neem Toddy.—A bottle of the spontaneous exudation of the *Neem* tree was received from the Conservator of Forests, Gwalior State, and it was analysed by Mr. T. P. Ghosh, B. Sc. This toddy is popularly regarded as a remedy for leprosy, and the object of the analysis was to determine its average composition. Only a trace of resinous and fatty matter was obtained and tests for alkaloids and glucosides gave negative results. No active principle, therefore, could be located.

A Note on the subject was published by Mr. Ghosh, B. Sc., in the *Indian Forester*, Vol. XXXIX, No. 6.

Nickel Tannates.—These salts were studied to some extent last year. It has already been reported that, under different conditions of precipitation, tannates of different nickel-content are obtained. These conditions have been further studied this year and it is found that not more than two salts can be obtained by any change in these conditions. One is obtained when nickel hydroxide, dissolved either in ammonium chloride or ammonium acetate, is added to an excess of tannic acid solution, and the other when tannic acid solution is added to an excess of nickel hydroxide solution. These salts gave on incineration the following percentage of NiO.

(*i*) The salt precipitated from excess of tannic acid . . . 8·74 %

(*ii*) The salt precipitated from excess of nickel hydroxide solution 22·24 %

These salts were the same as reported last year and the question of their constitution has yet to be settled.

The work will probably be continued next year.

(e)—*Forest Zoology.*

Sal Insect Pests.—The work has been confined to the United Provinces, and Dr. A. D. Imms, Forest Zoologist, made a short tour in the *Sal* forests of the Siwalik Division. The investigation of the late larva, the pupa and the imago of *Aeolesthes holosericea* has now been completed. The study of the eggs and early larval stages is being continued. The work has had to be much curtailed owing to no further accommodation for breeding experiments being available in the present quarters of the Forest Zoologist. A large number of male and female imagines and pupae of *Aeolesthes holosericea* was found in a felled trunk of *Terminalia tomentosa* in the Hoshangabad Forest Division, Central Provinces.

Three Bombycid moths bred from the larvae defoliating *Sal* leaves received from Pilibhit Forest Division, mentioned in last year's report, were identified by Sir George Hampson as *Euproctis scintillans*, Wlk. or a species close to it.

The Coccinellid larvae predaceous upon Monophlebus scale insects as reported last year have been identified by Mr. J. Weise as *Macronocius indicus*, sp. nov.

Caterpillars of the Noctuid moth *Ophiusa tirrhaca*, Gram. and of the Pyralid moths, *Chalcidoptera straminalis*, Guer. and *Macalla monousalis*, Wlk. were reported as attacking *Sal* trees in the Morha Range of Kheri Forest Division.

There is no previous record of *Ophiusa tirrhaca*, Cram. and *Chalcidoptera straminalis*, Guer. attacking *Sal*.

Lac Investigtions.—The work of studying the parasites of Butea *lac* has made considerable progress, and nearly 2,000 specimens of such parasites have been reared up to date. These are gradually being worked out by various specialists abroad. Touring has been undertaken in three Forest Divisions in the Central Provinces and in Rewah State for the purpose of obtaining information regarding local conditions and the frequent causes of failure of the *lac* crop. A biological study of the *lac* insect itself is now nearly complete, and it is hoped that this will serve to correct many of the errors prevailing with reference to the insect and will be useful for reference to all interested in *lac* cultivation, seeing that a reliable account does not at present exist.

The *Indian Forest Records*, Vol. IV, Part II, containing descriptions of the new parasitic Hymenoptera, bred from *lac*, described by the late Mr. P. Cameron, was issued from the Press during the year.

The investigation regarding the Coccid attacking Chir pine in the Naini Tal Forest Division was continued during the year, and a large part of the life history of the insect has been ascertained. The insect has been sent to Professor R. Newstead for dentification. Two species of Coccinellidae, the larvae of which are predaceous on this Coccid, have been determined by Mr. J. Weise as follows :—

1. *Exochomus uropygialis*, Muls.
2. *Nephus seocrini*, Ws.

A study of the various species of Termites found in the Indian forests. The work of collecting specimens of white-ants and notes relating to the damage done by them was continued, and specimens have been received from nearly all parts of India. A large number were sent to Professor Dr. F. Silvestri, of Portici, Italy, for identification.

Scolytidae attacking Blue pine (*Pinus excelsa*) and Chir pine (*Pinus longifolia*) in the Chakrata Forest Division. Dr. A. D. Imms, Forest Zoologist, inspected the affected areas on a short visit in October 1912. The damage done was due to the following species :—

(1) *Polygraphus longifolia*, Steb.
(2) *Polygraphus minor*, Steb.
(3) *Polygraphus major*, Steb.
(4) *Tomicus longifolia*, Steb.
(5) *Scolytus deodara*, Steb.

The following predaceous insects were also noted :—

(1) *Platysoma rimoe*, Lewis (Histeridæ).
(2) *Nipomius canalicollis*, Lewis (Niponiidae).

SECTION 3.—Collections and Records.

(a) *Museums and Collections.*

The principal work carried out by the officers in charge of the various branches is as follows :—

Sylviculturist.—130 photographs and 139 negatives were added during the year, making a total of 1,779 photographs and 1,128 negatives in the Photograph Collection. A catalogue of the collection up to 1st November 1911 was published during the year.

Botanist.—2,023 sheets were added to the herbarium during the year, the chief contributions being 758 sheets from Mr. Lace, 104 from the Bureau of Science, Manilla, 94 from Mr. Rogers, and 54 each from Rai Bahadur Kanjilal and the Divisional Forest Officer of Katha Division. 518 unnamed sheets belonging to the old Saharanpur collection were named and incorporated during the year.

Work on the card index catalogue of the herbarium was continued, and this should be completed early next year. A card catalogue was also commenced for all new species of forest importance which are not included in Brandis' "Indian Trees." This catalogue will be kept up to date and will greatly facilitate the correct identification of forest species. It is proposed to publish the annual additions made to this catalogue in the *Indian Forester* for general information.

Economist.—The Economic and Wood collections were kept up to date, the number of specimens added to the former being 86 and to the latter 43. Besides these collections a special collection of teak specimens was put together, the exhibits being collected from most divisions of Burma and India; similarly a *Sal* collection has been started. Considerable additions were made to the collection of large planks prepared from the most important and commercially valuable timbers found in the State forests of British India. When complete this collection should form a very fine exhibit. Another special collection of timbers used for tea boxes was commenced during the year and is now nearly completed.

Zoologist.—Specimens of some 500 species were added to the reference collection during the year, and a number of new species have been described from among the specimens submitted to specialists for identification.

(b) *Ledgers.*

Mr. Benskin having been posted as an assistant to the Economist's office, the old ledger files were re-arranged and classified according to the card index system and work was also commenced on the files received last year from the Reporter on Economic Products.

(c) *Library.*

The principal additions to the Library during the year are as follows:—

Botanical section.—117 books were added at a cost of Rs. 716.

Zoological section.—Books and journals to the value of Rs. 6,000 were purchased during the year.

SECTION 4.—Publications.

In Appendix I will be found a list of publications which were put into type during the year. Appendix II shows all the publications issued by the Institute since it came into existence.

CHAPTER III.

Financial.

The expenditure of the past two years is compared below.

Budget Head.	Expenditure during the year		Difference + or −
	1911-12.	1912-13.	
	Rs.	Rs.	Rs.
AVI.—Stores, Tools and Plant	5,957	6,376	+419
AVII.—Buildings, etc.	2,806	4,972	+2,166
AIX.—Miscellaneous	14,855	17,373	+2,518
BI*a*.—Conservators	8,520	11,087	+2,567
BI*b*.—Superior Officers	64,757	57,512	−7,245
BI*c*.—Subordinate Forest and Depôt Establishment	2,092	2,310	+218
BI*d*.—Office Establishment	23,946	24,119	+173
BI*e*.—Deputation and Special Allowances	7,718	13,204	+5,486
BII.—Travelling Allowances	8,897	8,777	−120
BIII.—Contingencies	18,877	22,113	+3,236
Total	1,58,425	1,67,843	+9,418

The increase under AVI is due to the purchase of more instruments, furniture and tents for the Research Institute.

The increase under AVII is due to the contribution towards the construction of the Coronation Hospital having been charged to the Research Institute and under AIX*b*) to extensive experiments in connection with the antiseptic treatment of timbers and to the gradual expansion of work generally.

The increase under BI(*a*) is due to half the pay of the President having been charged to the Institute for 12 months instead of for 9 months as in the preceding year.

The decrease under BI (*b*) is due to the departure of Dr. A. D. Imms on leave and to the non-employment of Mr. Raitt, Cellulose Expert, as a salaried officer, as was the case in the preceding year.

The increase under BI(*c*) is due to the promotion of one of the assistants to the Sylviculturist and to none of them having been obliged to take sick leave on half-pay, as was the case with one of them in the previous year.

The increase under BI(*d*) is due to more acting allowances having been drawn by members of the clerical establishment in leave vacancies.

The increase under BI(*e*) is due to honoraria having been drawn by Messrs. Raitt and Pearson for certain publications during the year.

The decrease under BII is small, and requires no special remark.

The increase under BIII is chiefly due to the purchase of books during year by the Zoologist.

CHAPTER IV.

Miscellaneous.

Indents.—The various indents received for seeds, specimens, etc., have been complied with as far as possible and the results are shown in Appendix III.

Programmes.—Work was carried out, as usual, in accordance with the sanctioned triennial programme. Towards the close of the year the two annual programmes hitherto called for from Research officers were abolished and replaced by a single annual return showing the tours and work which it is proposed to undertake during the coming forest year. At the same time the two annual returns shewing the progress of research work were abolished and this will materially decrease the office work of Research officers. The triennial programme for the period 1913-16, recommended by the Board of Forestry during the year, and which received the approval of the Government of India shortly after the close of the year, is printed in Appendix IV.

Establishment.—The most urgent question in this connection is the supply of assistants to Research officers. Assistants of two classes are required : (1) high-grade officers who will be employed in extending the field of original research work and (2) low-grade officers who will dispose of the relatively unimportant work on which it is false economy to employ highly paid expert officers. Unless this question is adequately solved the help now being sought by the officers of the Forest and other Departments as well as by the outside public, on an ever-expanding scale, from the officers of the Institute must be refused and the full value of the men we already have will not be realised.

Buildings.—The new Research Institute buildings were commenced and vigorously pushed forward during the year, and it is hoped that they will be ready for occupation next year. The site for a new hospital was selected, the plans passed and necessary funds obtained. Construction commenced shortly after the close of the year.

Research Offices.—Three offices were inspected during the year, and the remaining two offices immediately after the close of the year and were found in good order.

Acknowledgments.—All branches report liberal assistance received from the officers of the Department, and the President desires to cordially acknowledge the help that has been given to the Institute by members of the Department and others during the year.

The work of the various officers on the staff of the Institute has been thorough and satisfactory, and good progress has been made under great difficulties in the way of insufficient staff and accommodation.

R. S. HOLE,

Offg. President, Forest Research Institute and College.

APPENDIX—I.

List of Forest Publications put into type during the year 1912-13.

Branch of Research.	Name of Publication.	Author.	Form in which issued.	Remarks.
Botany Series	**I.—Bulletins.**			
	Preparation of Indian Forest Floras and Descriptive Lists.	R. S. Hole	Bulletin	In Press.
	II.—Records. *Nil.*			
	III.—Memoirs. *Nil.*			
	IV.—Manuals. *Nil.*			
Chemistry Series.	**I.—Bulletins.**			
	Note on Turpentines of *Pinus Khasya*, *Pinus Merkusii* and *Pinus excelsa*.	Puran Singh	Bulletin	In Press.
	II.—Records. *Nil.*			
	III. Memoirs. *Nil.*			
Economy Series	**I.—Bulletins.**			
	Note on Lingo Protector as a possible means of preventing timber from splitting while seasoning.	R. S. Pearson	Bulletin No. 13	Issued in March 1913.
	A further Note on the Relative strength of Natural and Plantation Grown Teak in Burma.	Do.	Bulletin No. 14	Do.
	Note on the Technical Properties of Timber (with special reference to the behaviour of *Cedrela Toona* wood while seasoning).	Do.	Bulletin No. 15	Do.
	II.—Records.			
	Note on the Tea-box Industry in Assam.	Do.	Record, Volume V, Part I.	Issued in June 1913.
	Report on the investigation of Savannah Grasses as material for production of Paper-pulp.	W. Raitt and R. S. Hole.	Record	In Press.
	III.—Memoirs.			
	Note on the Economic value of *Shorea robusta* (Sal).	R. S. Pearson	Memoir	In Press.
Sylviculture Series.	**I. Bulletins.**			
	Note on the Causes and Effects of the Drought of 1907 and 1908 in the *Sal* Forests of the United Provinces.	R. S. Troup	Bulletin No. 22	Issued in May 1913.
	II.—Records.			
	Note on the Blue Gum Plantations of the Nilgiris.	Do.	Record, Volume V, Part II.	Issued in June 1913.
	III.—Memoirs. *Nil.*			
	IV.—Other Publications.			
	Note on the Collection and Tabulation of Statistical Data in the Sylviculture Branch of the Forest Research Institute, Dehra Dun.	Do.	Foolscap size	Issued in January, 1913.
Zoology Series	*Nil.*			
Miscellaneous	Explanatory Notes on Forest Law (a new edition of the Forest Law Manual).	.....	Manual	In Press.

APPENDIX II.

List of all Forest Publications issued since the creation of the Forest Research Institute.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
		I.—Bulletins, Old Series.			*Rs. a. p.*	
1	Zoology .	Note upon the Bee-Hole Borer of Teak in Burma.	E. P. Stebbing, I. F. S., F. L. S., F. Z. S., F.E.S., Forest Zoologist.	Bulletin No. 1	0 4 0	Issued in 1905.
2	Do. .	Note on the Quetta Borer (*Æolesthes sartus*).	Do. do. .	Do. 2	0 8 0	Do.
3	Do. .	Note on the Chilgoza (*Pinus Gerardiana*) Bark-boring Beetles of Zhob, Baluchistan.	Do. do. .	Do. 3	0 8 0	Do.
4	Economy .	*Ficus elastica*: its natural growth and artificial propagation; with a description of the method of tapping the tree and of the preparation of its rubber for the market.	E. M. Coventry, I. F. S., Deputy Conservator of Forests.	Do. 4	0 12 0	Issued in 1906.
5	Zoology .	Notes on a Visit to some European Schools of Forestry.	E. P. Stebbing, I. F. S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 5	2 0 0	Issued in 1905.
6	Economy .	Memorandum on Mechanical Tests of some Indian Timbers.	W. H. Everett, B. A., B.E., M.I. Mech. E., M.I.E.E., Professor of Mechanical and Electrical Engineering, Sibpur Engineering College.	Do. 6	0 2 0	Issued in 1906.
7	Zoology .	Note on the Chilgoza Forests of Zhob and the Takht-i-Suleiman.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 7	0 12 0	Do.
8	Do. .	Note on the Life-history of *Hoploceram Byn spinicornis* (the Singbhum Sal Borer).	Do. do. .	Do. 8	0 9 0	Do.
9	Sylviculture	Notes on the Influence of Forests on the Storage and Regulation of the Water Supply.	S. Eardley-Wilmot, I.F.S., C.I.E., Inspector-General of Forests to the Government of India.	Do. 9	1 0 0	Do.
10	Zoology .	Note on the Duki Fig Tree Borer of Baluchistan (*Batocera rubus*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 10	0 7 0	Do.
11	Do. .	On some Assam Sal (*Shorea robusta*) Insect Pests.	Do. do. .	Do. 11	1 10 0	Do.
		II.—Leaflets.				
1	Zoology .	The Sal Bark Borer (*Sphærotrypes siwalikensis*, Steb.).	E. P. Stebbing, I.F.S. F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Leaflet No. 1	0 4 0	Issued in 1908.
2	Do. .	The Teak Defoliator (*Hyblæa puera*, Cram).	Do. do. .	Do. 2	0 2 0	Do.
3	Do. .	The Teak Leaf Skeletoniser (*Pyrausta machæralis*, Wlk).	Do. do. .	Do. 3	0 2 0	Do.
4	Do. .	The Larger Deodar Bark Borer (*Scolytus major*, Steb.)	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 4	0 4 0	Issued in 1910.
5	Do. .	The Blue Pine "*Polygraphus* Bark Borer" (*Polygraphus major*, Steb.).	Do. do. .	Do. 5	0 3 0	Do.

Note.—The Leaflet series has been discontinued.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
		III.—Pamphlets.			*Rs. a. p.*	
1	Chemistry .	Note on the Utilization of Khair forests in Eastern Bengal and Assam.	Puran Singh, F.C.S., Acting Forest Chemist.	Pamphlet No. 1	0 4 0	Issued in 1908.
2	Zoology .	The Attack of Barkboring Beetles in the Coniferous forests on the Simla Catchment Area.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. 2	0 8 0	Do.
3	Working-Plans	A Glossary of Technical Terms for Use in Indian Forestry.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent, Forest Working Plans.	Do. 3	0 4 0	Do. (Revised and issued as Bulletin No. 4, New Series).
4	Economy .	Lac and Lac cultivation .	D. N. Avasia, Extra-Assistant Conservator of Forests.	Do. 4	0 2 0	Issued in 1909.
5	Sylviculture .	Notes on Sal in Bengal .	A. L. McIntire, I.F.S., Conservator of Forests, Bengal.	Do. 5	0 4 0	Do.
6	Do. .	Forest Reservation in Burma in the interests of an Endangered Water-supply.	A. Rodger, I.F.S., Deputy Conservator of Forests.	Do. 6	1 0 0	Do.
7	Economy .	Andaman Marble Wood or Zebra Wood (*Diospyros Kurzii*, Hiern).	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Do. 7	0 4 0	Do.
8	Working-Plans	The Collection of Statistical Data relating to the principal Indian species.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working Plans.	Do. 8	0 10 0	Issued in 1910.
9	Do. .	Tables showing the Progress in Working-Plans in the Provinces outside the Madras and Bombay Presidencies up to 31st December 1908.	Do. do. .	Do. 9	0 10 0	Do.
10	Economy .	Note on Burmese Leza Wood (*Lagerstræmia tomentosa*, Presl).	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Do. 10	0 2 0	Do.
11	Do. .	Note on Carallia Wood (*Carallia integerrima*, D.C.)	Do. do. .	Do. 11	0 2 0	Do.
12	Do. .	Petwun or Trincomali Wood (*Berrya Ammonilla*, Roxb).	Do. do. .	Do. 12	0 4 0	Do.
13	Do. .	Burmese In Wood (*Dipterocarpus tuberculatus*, Roxb).	Do. do. .	Do. 13	1 0 0	Issued in 1909.
14	Do. .	Burma Padauk (*Pterocarpus macrocarpus*, Roxb).	Do. do. .	Do. 14	1 0 0	Do.
15	Zoology .	Note on the Preservation of Bamboos from the Attacks of the Bamboo Beetle or "Shot-Borer."	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S.	Do. 15	0 7 0	Issued in 1910.
16	Botany .	Note on Best Season for Coppice Fellings of Teak.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S.	Do. 16	0 4 0	Do.

Note—The Pamphlet Series has been discontinued.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
					Rs. a. p.	
		IV.—Bulletins (New Series).				
1	Chemistry	Note on Calorimetric Tests of Some Indian Woods.	Puran Singh, F.C.S., Forest Chemist.	Bulletin No. 15	0 2 0	Issued in 1911.
2	Sylviculture .	Memorandum on Teak Plantations in Burma.	F. A. Leete, F.C.H., Dy. Conservator of Forests, Burma.	Do. 2	0 10 0	Do.
3	Economy .	Note on the Relative Strength of *natural* and *plantation-grown* Teak in Burma.	R. S. Pearson, F.L.S., Forest Economist.	Do. 3	0 4 0	Do.
4	Sylviculture .	Second Edition of Mr. Caccia's Glossary of Technical Terms for use in Indian Forestry.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. 4	0 6 0	Do.
5	Zoology .	The Blue Pine *Tomicus* Bark-Borer.	E. P. Stebbing, F.L.S., F.Z.S., F.R.G.S., F.E.S.	Do. 5	0 2 0	Do.
6	Chemistry .	Note on the Oil Value of Sandal Wood.	Puran Singh, F.C.S., Forest Chemist.	Do. 6	0 2 0	Issued in 1912.
7	Do. . .	Note on the Chemistry and Trade forms of Lac.	Do. do. . .	Do. 7	0 3 0	Do.
8	Sylviculture .	Note on some Germination Tests with Sal seed (*Shorea robusta*).	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. 8	0 2 0	Do.
9	Chemistry .	Note on Resin Value of *Podophyllum Emodi* and the best season for collecting it.	Puran Singh, F.C.S., Forest Chemist.	Do. 9	0 1 3	Do.
10	Zoology. .	Note on Bark-Boring Beetle attack in the Coniferous Forests of the Simla Catchment Area, 1907-11.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S.	Do. 10	0 3 0	Do.
11	Do. . .	A Further Note on some *Casuarina* Insect Pests of Madras.	V. Subramania Iyer, M.A., F.L.S., F.Z.S., late Forest Zoologist.	Do. 11	0 14 0	Do.
12	Do. . .	Note on the Bark-Eating and Root-Boring Beetles of Babul (*Acacia arabica*).	E. P. Stebbing, F.L.S., F.Z.S., F.R.G.S., F.E.S.	Do. 12	0 4 0	Do.
13	Economy .	Note on *Ligno Protector* as a possible means of preventing timber from splitting while seasoning.	R. S. Pearson, I.F.S., F.L.S., Forest Economist.	Do. 13	0 5 0	Issued in 1913.
14	Do. . . .	A further Note on the Relative Strength of Natural and Plantation-grown Teak in Burma.	Do. do. . .	Do. 14	0 3 0	Do.
15	Do. . .	Note on the Technical Properties of Timber with special reference to the behaviour of *Cedrela Toona* wood while seasoning.	Do do. .	Do. 15	0 3 0	Do.
16	Do. . .	Note on Gumhar (*Gmelina arborea* Roxb).	A. Rodger, I.F.S. . .	Do. 16	0 3 0	Do.
17	Do. . .	Note on Bija Sal or Vengai (*Pterocarpus Marsupium*, Roxb).	Do. do. . .	Do. 17	0 4 0	Do.
18	Do. . .	Note on Sain or Saj (*Terminalia tomentosa*, W. and A.).	Do. do. . .	Do. 18	0 5 0	Do.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
					Rs. a. p.	
		IV.—Bulletins (New Series)—*contd.*				
19	Economy .	Note on Benteak or Nana Wood (*Lagerstræmia lanceolata*, Wall.).	A. Rodger, I.F.S. . .	Bulletin No. 19	0 3 0	Issued in 1913.
20	Do. . .	Note on Saudan (*Ougeinia dalbergioides, Benth.*)	Do. . . .	Do. 20	0 3 0	Do.
21	Do. . .	Note on Dhaura or Bakli *Anogeissus latifolia*, Wall.).	Do. . . .	Do. 21	0 4 0	Do.
22	Sylviculture .	Note on the Causes and Effects of the Drought of 1907 and 1908 in the *Sal* Forests of the United Provinces.	R. S. Troup, F.C.H., I.F.S., Sylviculturist.	Do. 22	0 5 0	Do.
		V.—Records.				
1	Zoology . .	A Note on the Lac Insect (*Tachardia lacca*). Its Life-History, Propagation and Collection.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Record, Vol. I, Part I.	1 4 0	Issued in 1908.
2	Working-Plans	A Preliminary Note on the Development of the *Sal* in Volume and in Money Value.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working Plans.	Record, Vol. I, Part II.	1 4 0	Do.
3	Economy .	*Pterocarpus dalbergioides*, Roxb. (Andaman padauk).	B. B. Osmaston, I.F.S., Conservatot of Forests, United Provinces.	Record, Vol. I, Part III.	1 4 0	Do.
4	Zoology .	A further Note on the Chilgoza Bark-Boring Beetles of Zhob.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.			
5	Economy .	A Note on the Present Position and Future Prospects of the Cutch Trade in Burma.	R. S. Troup, I.F.S., F. C. H., Forest Economist.			
6	Chemistry .	Note on the Manufacture of Ngai Camphor.	Puran Singh, F.C.S., Acting Forest Chemist.			
7	Do. . .	A Chemical Investigation of the Constituents of Burmese Varnish (*Melanorrhœa usitata*, Sap.).	Do. do. .	Record, Vol. I, Part IV.	1 4 0	Do.
8	Working-Plans	The Selection System in Indian Forests as exemplified in Working Plans, based on this system, with a short description of some Continental Methods.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working Plans.			
9	Zoology. .	Note on Some Insect Pests of the Himalayan Oaks (*Quercus dilatata* and *Quercus incana*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Record, Vol. II, Part I.	0 6 0	Do.
10	Economy .	Note on the Fissibility of some Indian Woods.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Record, Vol. II, Part II.	1 6 0	Issued in 1910.
11	Sylviculture .	Monograph on the Sylviculture of *Hardwickia binata* (Anjan).	D. O. Witt, Dy. Conservator of Forests, Central Provinces.	Record, Vol. II, Part III.	3 4 0	Do.
12	Botany . .	Notes on Sandal (Germination and Growth of Sandal Seedlings).	Rao Sahib M. Rama Rao Garu, Conservator of Forests, Travancore.			
13	Do. .	Note on Host Plants of the Sandal Tree.	Do. do. . .	Record, Vol. II, Part IV.	2 0 0	Issued in 1911.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
					Rs. a. p.	
		V.—Records—*contd.*				
14	Working-Plans	Note on some Statistical and other Information regarding the Teak Forests of Burma.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Record, Vol. III, Part I.	2 12 0	Issued in 1911.
15	Economy .	Preliminary Note on the Antiseptic Treatment of Timber in India with special reference to Railway Sleepers.	R. S. Pearson, I.F.S., F.L.S., Forest Economist.	Record, Vol. III, Part II.	0 14 0	Issued in 1912.
16	Do. .	Report on the Investigation of Bamboo as a material for Production of Paper-pulp.	W. Raitt, F.C.S., Cellulose Expert.	Record, Vol. III, Part III.	0 6 0	Do.
17	Chemistry .	Note on the Preparation of Tannin Extracts, with special reference to those prepared from the Bark of Mangrove (*Rhizophora mucronata*).	Puran Singh, F.C.S., Forest Chemist.	Record, Vol. III, Part IV.	0 7 0	Do.
18	Do. .	Note on the Distillation and Composition of Turpentine Oil from the Chir Resin and the Clarification of Indian Rosin.	Do. do. . .	Record, Vol. IV, Part I.	0 9 0	Issued in 1913.
19	Zoology . .	Note on some new and other species of Hymenoptera in the Collections of the Zoological Branch of the Forest Research Institute, Dehra Dun.	P. Cameron . . .	Record, Vol. IV, Part II.	0 4 0	Do.
20	Botany .	Note on Useful Exotics in Indian Forests (No. 1 *Prosopis juliflora*, D.C.).	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S., Forest Botanist.	Record, Vol. IV, Part III.	0 4 0	Do.
21	Do. . .	Note on *Albizzia Lathamii*.	Do. do. . .	Record, Vol. IV, Part IV.	0 3 0	Do.
22	Economy .	Note on the Utilization of Bamboo for the Manufacture of Paper-pulp.	R. S. Pearson, I.F.S., F.L.S., Forest Economis	Record, Vol. IV, Part V.	2 6 0	Do.
23	Do. . .	Note on the Tea-box Industry in Assam.	Do. do. . .	Record, Vol. V, Part I.	0 4 0	Do.
24	Sylviculture .	Note on the Blue Gum Plantations of the Nilgiris.	R. S. Troup, F.C.H., I.F.S., Sylviculturist.	Record, Vol. V, Part II.	1 6 0	Do.
		VI.—Memoirs.				
1	Zoology .	On some Undescribed *Scolytidæ of* Economic Importance from the Indian Region, I.	E. P. Stebbing, F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Memoir, Vol. I, Part I.	0 4 0	Issued in 1908.
2	Do. . .	Second Monograph on some Undescribed *Scolytidæ* of Economic Importance from the Indian Region, II.	Do. do. . .	Memoir, Vol. I, Part II.	0 4 0	Issued in 1909.
3	Do. . .	Second Edition of the Monograph on "Lac Insect" (*Tachardia lacca*).	Do. do. . .	Memoir, Vol. I, Part III.	1 0 0	Issued in 1910.
4	Do. . .	Note on Some Important Insect Pests of the Himalayan Coniferæ (treating Deodar).	Do. do. . .	Memoir, Vol. II, Part I.	4 10 0	Issued in 1911.

List of all Forest Publications issued since the creation of the Forest Research Institute—contd.

Serial No.	Branch of Research.	Name of Publication.	Author.	Form in which issued.	Price.	Remarks.
					Rs. a. p.	
		VI. Memoirs—*contd.*				
5	Chemistry .	Note on the Analysis of Cutch and the Preparation of Pure Catechin.	Puran Singh, F.C.S., Acting Forest Chemist.	Memoir, Vol. I, Part I.	1 4 0	Issued in 1908.
6	Do. . .	Note on the Manufacture of Pure Shellac.	Do. do. . .	Memoir, Vol. I, Part II.	0 8 0	Issued in 1909.
7	Economy .	Indian Woods and their Uses.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Memoir, Vol. I, Part I.	2 12 0	Issued in 1908.
8	Do. . .	Note on the Prospects of the Match Industry in the Indian Empire with particulars of Proposed Match Factory Sites and Woods suitable for Match Manufacture.	Do. do. . .	Memoir, Vol. II, Part I.	1 12 0	Issued in 1910.
9	Working-Plans	*Nil.*				
10	Botany . .	Note on Some Indian Grasses and their Œcology.	R. S. Hole, I.F.S., F.C.H., F.E.S., F.L.S., Forest Botanist.	Memoir, Vol. I, Part I.	5 8 0	Issued in 1911.
11	Sylviculture .	*Nil.*				
12	Zoology .	Note on Some Important Insect Pests of the Himalayan Coniferæ (*Pinus longifolia*).	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S.	Memoir, Vol. II, Part II.	1 14 0	Do.
		VII.—Manuals.				
1	Economy .	Manual of Indian Forest Utilization.	R. S. Troup, I.F.S., F.C.H., Forest Economist.	Manual . .	2 4 0	Issued in 1907.
2	Zoology .	Manual of Forest Zoology.	E. P. Stebbing, I.F.S., F.L.S., F.Z.S., F.E.S., Forest Zoologist.	Do. . .	10 0 0 *5 0 0	Issued in 1908.
3	Botany . .	Manual of Forest Botany	R. S. Hole, I.F.S., F.C.H., F.L.S., F.E.S., Forest Botanist.	Do. . .	3 8 0	Issued in 1909.
4	Working-Plans	Revised Fourth Edition of D'Arcy's Preparation of Forest Working-Plans in India.	A. M. F. Caccia, I.F.S., M.V.O., F.Z.S., Superintendent of Forest Working Plans.	Do. . .	0 14 0	Issued in 1910.
5	Sylviculture .	Second Edition of the Concise Manual of Sylviculture.	.....	Do. . .	1 0 0	Issued in 1911.
6	...	Manual of Forest Law .	.....	Do. . .	1 0 0	Issued in 1906.
7	Working-Plans	Manual of Forest Mensuration.	R. S. Troup, I.F.S., F.C.H., Sylviculturist.	Do. . .	1 4 0	Issued in 1911.

* For Officers below the rank of Extra Deputy Conservators.

List of all Forest Publications issued since the creation of the Forest Research Institute—concld.

Serial No.		Price.	Remarks.
		Rs. a. p.	
	VIII.—Other Publications.		
1	Practical Determination of the Girth Increment of Trees, by R. S. Troup, Sylviculturist	0 4 0	Issued in 1910.
2	Forest Flora of Chota Nagpur, by H. H. Haines, Conservator of Forests, Central Provinces.	9 0 0	Do.
3	Translation of M. Jacquot's "Incendies en Forêt," by C. E. C. Fischer, Dy. Conservator of Forests.	0 14 0	Do.
4	Tables for the Volume Measurement of Sample Plots, by R. S. Troup, Sylviculturist	0 8 0	Do.
5	Descriptive Catalogue of the Economic Museum of the Forest Research Institute and College, by R. S. Pearson, Forest Economist.	1 4 0	Issued in 1911.
6	Forest Flora of the Siwalik and Jaunsar Divisions, United Provinces (revised edition), by Rai Bahadur U. N. Kanjilal.	*1 4 0 †1 14 0	Do.
7	Working-Plan for the Thano Forests of the Siwalik Division by R. S. Troup, Sylviculturist	2 0 0	Do.
8	Report on the Preparation of Mangrove Tannin Extracts with special reference to the Govt. Factory at Rangoon, by Puran Singh, F.C.S., Forest Chemist.	*	Issued in 1912. (Not for sale or general distribution).
9	Commercial Guide to the Economic Forest Products of India, by R. S. Pearson, F.L.S., Forest Economist.	1 0 0	
10	Catalogue of the Photographic Collection at the Forest Research Institute, Dehra Dun	1 4 0	Issued in November 1912.
11	Note on the Collection and Tabulation of Statistical data in the Sylviculture branch of the Forest Research Institute.	(Not for sale).	Issued in 1913.

* For students, † For the public.

APPENDIX III.

Abstract from the Register of Seeds, Timbers and other Forest Produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest Year 1912-1913.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
26th September 1912	The Chief Conservator of Forests, British East Africa Protectorate.	Forest Botanist .	Michelia Champaca	Seed .	2 lbs.	
29th July 1912 .	Mons. Dode, 4, Place du Maine, Paris (15) France.	Do. . .	Quercus semicarpifolia.	Do. .	2 lbs.	
23rd August 1912 .	Do. do. .	Do. . .	Quercus dilatata .	Do. .	2 lbs.	
7th January 1913 .	The Chief Conservator of Forests, Union of South Africa, Forest Department, Pretoria.	Do. . .	Cedrus deodara .	Do. .	200 lbs.	
8th January 1913 .	Do. do. .	Do. . .	Do. . .	Do. .	335 lbs.	
17th January 1913 .	Do. do. .	Do. .	Pinus excelsa .	Do. .	3 lbs.	
7th January 1913 .	The Principal, Poona Agricultural College.	Do. . .	Cedrus deodara .	Do. .	2 lbs.	
3rd August 1912 .	The Director-General, Department of Agriculture, Cairo.	Do. . .	Bassia latifolia .	Do. .	10 lbs.	
7th August 1912 .	Do. do. .	Do. . .	Feronia Elephantum.	Do. .	1½ lbs.	
27th June 1913 .	Do. do. .	Do. . .	Bombax malabaricum.	Do. .	2 lbs.	
17th July 1912 .	The Agent-General in India for the British Protectorates in Africa, Bombay.	Do. . .	Cedrela Toona .	Do. .	10 lbs.	
7th January 1913 .	Do. do. .	Do. . .	Cupressus torulosa .	Do. .	7 lbs.	
30th September 1912 .	The Technical Adviser, Rhodesia Bacon Factories, Bulawao.	Do. .	Quercus serrata .	Do. .	4½ lbs.	
11th December 1912 .	Do. do. .	Do. . .	Albizzia Lebbek .	Do. .	2 lbs.	
23rd December 1912 .	Do. do. .	Do. . .	Quercus Ilex .	Do. .	8 lbs.	
9th July 1912 . .	The Tehsildar of Kosgi	Do. . .	Bambusa arundinacea.	Do. .	4 lbs.	
13th June 1913 .	The Chief Conservator of Forests, Union of South Africa, Pretoria.	Do. .	Pinus longifolia .	Do. .	120 lbs.	
21st February 1913 .	W. Pettierew, Esq., 257, Roe Street, West Perth, Western Australia.	Do. . .	Cephalostachyum pergracile.	Do. .	1 lb.	
4th March 1913 .	Do. do. .	Do. . .	Bambusa arundinacea.	Do. .	1 lb.	
7th March 1913 .	Do. do. .	Do. . .	Dendrocalamus longispathus.	Do. .	½ lb.	
27th March 1913 .	Do. do. .	Do. . .	Melocanna bambusoides.	Do. .	4 lbs.	In number.
24th April 1913 .	Do. do. .	Do. . .	Dendrocalamus strictus (Myin).	Do. .	...	In small quantity.
Do. do. .	Do. do. .	Do. . .	Dendrocalamus membranaceous (Wapyin).	Do. .	2 lbs.	
29th April 1913 .	Do. do. .	Do. . .	Dendrocalamus strictus (Myin).	Do. .	...	
Do. do. .	Do. do. .	Do. . .	Bambusa Tulda .	Do. .	...	In small quantity.

Abstract from the Register of Seeds, Timbers and other Forest Produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest Year 1912-1913—contd.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
2nd May 1913	W. Pettierew, Esq., 257, Roe Street, West Perth, Western Australia.	Forest Botanist	Melocanna bambusoides.	Seed	8 lbs.	
6th May 1913	Do. do.	Do.	Do. do.	Do.	44 lbs.	
10th June 1913	Do. do.	Do.	Oxytenanthera albociliata.	Do.	...	In small quantity.
12th June 1913	Do. do.	Do.	Bambusa arundinacea.	Do.	1 lb.	
Do. do.	Do. do.	Do.	Oxytenanthera albociliata.	Do.	1-3 lbs.	
Do. do.	Do. do.	Do.	Cephalostachyum pergracile.	Do.	1-9 lbs.	
Do. do.	Do. do.	Do.	Dendrocalamus strictus.	Do.	1-13 lbs.	
Do. do.	Do. do.	Do.	Melocanna bambusoides.	Do.	1-5 lbs.	
Do. do.	Do. do.	Do.	Dendrocalamus giganteus.	Do.	1-13 lbs.	
Do. do.	Do. do.	Do.	Bambusa Kingiana	Do.	1-27 lbs.	
Do. do.	Do. do.	Do.	Dendrocalamus strictus.	Do.	1-5 lbs.	
18th June 1913	Do. do.	Do.	Dendrocalamus Hamiltonii.	Do.	...	In small quantity.
Do. do.	Do. do.	Do.	Dendrocalamus Brandisii.	Do.	...	Do.
Do. do.	Do. do.	Do.	Cephalostachyum Virgatum.	Do.	...	Do.
28th February 1913	The Collector in Charge, Purneah.	Do.	Shisham	Do.	1 maund.	
Do. do.	Do. do.	Do.	Shisham	Do.	1 maund.	
Do. do.	Do. do.	Do.	Babul	Do.	1 maund.	
12th May 1913	The Officer in Charge, Horticultural Department, New Delhi.	Do.	Cephalostachyum pergracile.	Do.	...	In small quantity.
Do. do.	Do. do.	Do.	Bambusa Tulda	Do.	...	Do.
21st May 1913	Do. do.	Do.	Dendrocalamus strictus.	Do.	2 lbs.	
Do. do.	Do. do.	Do.	Bauhinia purpurea.	Do.	1 lb.	
Do. do.	Do. do.	Do.	Bauhinia variegata	Do.	1 lb.	
24th May 1913	Do. do.	Do.	Bambusa arundinacea.	Do.	5 lbs.	
28th May 1913	Do. do.	Do.	Dendrocalamus strictus.	Do.	...	In small quantity.
30th May 1913	Do. do.	Do.	Dillenia speciosa.	Do.	¼ lb.	
10th June 1913	Do. do.	Do.	Pterocarpus Marsupium.	Do.	2 lbs.	
Do. do.	Do. do.	Do.	Albizzia odoratissima.	Do.	2 lbs.	
Do. do.	Do. do.	Do.	Anogeissus latifolia.	Do.	2 lbs.	
11th June 1913	Do. do.	Do.	Bambusa Tulda	Do.	...	In small quantity.
Do. do.	Do. do.	Do.	Dendrocalamus longispathus.	Do.	...	Do.
Do. do.	Do. do.	Do.	Cephalostachyum pergracile.	Do.	...	Do.

Abstract from the Register of Seeds, Timbers and other Forest Produce supplied to British Colonies, Foreign Governments, Institutes, etc., during the Forest Year 1912-1913.—concld.

Date when supplied.	To whom supplied.	By whom supplied.	Name of species.	Kind of produce.	Quantity supplied.	Remarks.
13th June 1913	The Officer in Charge, Horticultural Department, New Delhi.	Forest Botanist	Dendrocalamus membranaceous.	Seed	...	In small quantity.
18th June 1913	Do. do.	Do. do.	Dendrocalamus Brandisii.	Do.	...	Do.
27th June 1913	Do. do.	Do. do.	Melocanna species	Do.	...	Do.
Do. do.	Do. do.	Do. do.	Bombax malabaricum.	Do.	2 lbs.	
Do. do.	Do. do.	Do. do.	Shorea robusta.	Do.	10 lbs.	
16th September 1912	The Superintending Nurseryman, State Forests Branch, Department of Lands, New Zealand, Tapanui.	Forest Economist	185 different species	Small wood specimens.	185.	
30th September 1912.	Director of Industries, United Provinces, Cawnpore.	Do. do.	Myrabolans	Fruit	5 lbs.	
			Sal (*Shorea robusta*)	Do.	12 lbs.	
			Mangrove	Bark	10 lbs.	
			Acacia arabica	Pods	1 lb.	
			Do. do.	Bark	2 lbs.	
12th October 1912	Do. do.	Divisional Forest Officer, W. D. Kanara (Bombay).	*Caesalpinia coriaria.*	Pods	10 lbs.	
24th October 1912	Mr. Oberbaurat Froschel, Berlin W. 35, Genthinerstr, 40—(Germany).	Forest Economist	Attacked pieces of untreated timbers.	Small scantlings.	6	
Do. do.	Stanley Luke, Esq., Hon. Secretary, Association of Manual Training Instructors, Perth, (W. A.).	Do. do.	60 different species.	Small wood specimens.	60	
7th November 1912	Principal, Higher Grade Training College, Allahabad.	Do. do.	24 different species.	Medium sized wood specimens.	24	
			Phyllanthus Emblica.	Bark	...	
6th January 1913	The Director of Industries, United Provinces, Cawnpore.	Do. do.	*Terminalia belerica.*	Fruit	...	
			Terminalia tomentosa	Bark		
10th March 1913	Conservator of Forests, Cochin State.	Do. do.	21 different species.	Timber specimens (small).	21	
28th April 1913	Lady Supervisor, St. Mary's Convent High School, Allahabad.	Do. do.	(1) 24 different species.	(1) Barks and roots.	24	
			(2) 47 different species.	(2) Timber.	...	
Do. do.	Superintendent, St. Mary's Convent High School, Ramnee, Naini Tal.	Do. do.	.....	Elephant tusk, Mineral, Limestone.	1 piece.	
				Sandal wood specimens.	Do.	
Do. do.	Dr. Theodar Paul, Munich, Germany.	Do. do.	*Dipterocarpus tuberculatus.*	Resin	1 bottle.	
			Dipterocarpus alatus.	Oil	Do.	
			Dipterocarpus turbinatus.	Do	Do.	
			Boswellia serrata	Gum	2 lbs.	
			Canarium resiniferum	Resin	2 lbs.	
			Cassia Fistula	Pods	1 bundle.	
20th May 1913	Curator, Department of Botany, Field Museum of Natural History, Chicago, America.	Do. do.	Specimens of various forest products.	Timber, fibre, flowers, dye, fruits, root, gum, rosin and bark, etc.	40	

APPENDIX IV.

PROGRAMME OF WORK FOR THE FOREST RESEARCH INSTITUTE FOR THE PERIOD 1913-14 TO 1916-17.

A.—PROGRAMME OF THE SYLVICULTURIST.

Part I.—Investigations in connection with Sal (*Shorea robusta*).

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	*Sylvicultural Systems.*—The application of the Uniform or Group Systems or modifications of them, to *Sal* forest.	(1) Thano Forest, Dehra Dun . .	(1) A Working-Plan for converting the Thano Forest into a series of evenaged coupes has been prepared and the effects will be watched.
		(2) Other *Sal* tracts in different provinces.	(2) Similar experimental working will be applied, and the effects watched in other localities under different conditions.
2	*Natural Regeneration.*—Experiments to ascertain the best methods of ensuring natural regeneration of *Sal* under different conditions.	(1) Already in progress in parts of the United Provinces.	(1) These experiments will be carried out on comparatively broad lines in order to test the general effect of operations employed in practical sylviculture. The investigation is being worked out by the Forest Botanist for seedlings up to 2 years of age with a view to ascertaining the effect of various factors in influencing development or mortality.
		(2) Will be extended to *Sal* tracts in other provinces.	
3	*Artificial regeneration.*—Methods of cultivating *Sal* artificially.	(1) Initial experiment in progress at Dehra Dun.	.....
		(2) Will be extended to forest tracts when sufficient experience has been gained from initial experiments.	.....
4	*Seed and Seed Years.*—Effect of age of trees and environment on production of seed and on frequency of seed years. Fertility of *Sal* coppice seed and quality of resulting plants.	Various *Sal* tracts in different provinces.	(1) Much information regarding seed years has already been collected. (2) The effect of age of trees and environment on seed production has been studied during the past three years, and a note embodying results so far obtained has been published.
5	*Coppice.*—Experiments to find out the best methods of cutting and working *Sal* coppice.	Experiments already in progress in the Siwalik and Gonda Divisions, United Provinces. Will be extended to other localities.	.....
6	*External dangers.*—Effects of drought, fire, frost, grazing, suppression and other dangers.	Investigations have been in progress in the United Provinces. Will be extended to other provinces.	As in Serial No. 2. A note on the effects of drought has been published.
7	*Rate of Growth and volume of Production.*—The establishment of sample plots in representative *Sal* crops. Classification of different qualities of locality.	The work has been progressing steadily for the past 2 years in the United Provinces and will be continued in other provinces as far as time and staff permit.	Imperial officers as assistants are much needed in each province concerned to carry on this important work.
8	*Thinnings.*—The execution of thinnings in sample plots with the object of ascertaining the optimum density of crop under different conditions.	Ditto ditto.	Ditto ditto.
9	*Physical Conditions.*—The effect of geological formation, drainage, subterranean water level and other factors on *Sal* development.	Already in progress, chiefly in connection with sample-plot investigations.	As in Serial No. 2. The Botanist is studying the effect of soil moisture in the experimental garden. The Sylviculturist will prosecute investigations based, as far as possible, on the Botanist's results, in the forest, particularly with a view to ascertaining (1) the time taken for *Sal* reproduction to establish itself and (2) the rate of growth and development of *Sal*, under different physical conditions.
10	*Miscellaneous.*—The collection of information on various statistical and sylvicultural matters connected with the *Sal* including a study of its more important companions.	Already in progress in the United Provinces. Will be continued in other provinces.	.....

A.—SYLVICULTURIST PROGRAMME—*contd.*

Part II.—Miscellaneous Investigations.

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	*Sylvicultural Systems.*—The uniform and group systems of working forests or modifications of them as applied to Indian conditions, will be studied in respect of various important species adapted to these methods of treatment.	Investigations already in hand in respect to forests of *Pinus longifolia*, Deodar, and oaks in the United Provinces. Will be extended, as far as possible, to the same species in the Punjab, to teak and *In* forests in Burma, and to *Pinus Khasya* in Assam.	
2	*Plantations.*—Compilation of statistics of plantations of various species, with a view to framing financial forecasts: enquiries regarding the best methods, culturally and economically, of raising and working plantations.	Completed so far for the Eucalyptus plantations in the Nilgiris, and in part for the teak plantations of S. Malabar. Will be extended, as far as possible to all important plantations.	This work is of great importance financially, and the want of an adequate staff to carry it on in each province is much felt.
3	*Bamboos.*—Investigations into the best methods of cutting and working bamboos.	In progress for *Dendrocalamus strictus* in the United Provinces; will be undertaken in other provinces and for other species as far as time and staff permit.	
4	*Pollarding for lac cultivation.*—The pollarding of trees for *lac* cultivation, with a view to working them in rotation for the production of the maximum yield of *lac.*	In progress in the United Provinces.	
5	*Miscellaneous Sylvicultural Investigations.*—The sylvicultural characters of different species of trees will be studied both in the forest and in the experimental gardens, among other questions investigated being the manner in which germination takes place, the conditions most favourable for germination and natural reproduction, artificial regeneration including nursery treatment and transplanting, seedling and seed years, fertility of seed, rate of growth and other statistical information, susceptibility to frost, suppression and other dangers, and sylvicultural characteristics generally. A special study in this respect is being made of the important conifers and oaks of the Himalayas.	A large number of investigations of this nature are in progress in the experimental gardens at Dehra Dun and numerous observations have been recorded in the forest where experimental plots have been established in various localities. The scope of these investigations will be enlarged as far as conditions permit.	Assistance is much needed to carry on this work under different climatic conditions, since the number of species which can be dealt with at Dehra Dun is limited. Collections and drawings, if necessary, of seedlings of species of economic or sylvicultural importance may be made by the Sylviculturist to assist him in his work, but detailed and systematic descriptions of seedlings by genera or otherwise come under the head of pure botany, and will not be undertaken.
6	**Natural Regenerations of Teak.*—Best means of ensuring this successfully and cheaply under different conditions.	Will be undertaken, as far as condition will permit, in Madras, Bombay, Central Provinces, and Burma.	*Enquiry suggested by Conservator of Forests, Western Circle, Madras.
7	†*Regeneration of Forests of Picea Morinda and Abies Pindrow.*—Experiments to find out the most satisfactory means of effecting it.	United Provinces and Punjab . .	†Enquiries suggested by Conservator of Forests, Western Circle, United Provinces.
8	†*Artificial Regeneration of Deodar.*—The best and cheapest means of effecting it.	Ditto ditto . .	.....
9	*Fire in *Pinus longifolia* forests: its possible use and the means of applying it for effecting natural reproduction.	Ditto ditto . .	* Enquiries suggested by Conservator of Forests, Western Circle, United Provinces.
10	**Coppice Experiments.*—The best height for coppicing miscellaneous species.	United Provinces . . .	
11	† *Pterocarpus santalinus.*—Enquiries regarding— (1) Rate of growth. (2) Effect of soils on girth increment and the formation of red wood. (3) Periods at which red wood forms and reaches its greatest development. (4) Exploitable age. (5) Effect of coppicing on production of red wood.	N. and E. Cuddapah Divisions, Madras.	†Enquiry suggested by Conservator of Forests, Central Circle, Madras; details of the investigation will be carried out by local officers.

B.—Programme of the Forest Botanist.

Part I.—Investigations into certain matters connected with the Sal Tree (Shorea robusta).

Serial No.	Subjects and details of investigation.	Locality of investigation.	Remarks.
1	*Study of the Œcology and Physiology of Sal* with the object of discovering (*a*) the intensity at which the factors of soil composition, soil moisture, soil-aeration, temperature, air humidity and light suffice to cause disease or death in *Sal* seedlings and (*b*) which are the dominant or limiting factors chiefly affecting the healthy development of *Sal* seedings and the distribution of the species in nature and how these factors can be controlled.	United Provinces, Bihar and Orissa, Bengal, Assam, Central Provinces and North Madras.	In hand and will be continued. So far as the investigation deals with soil characters, the co-operation of the Forest Chemist will be necessary.
2	*Study of the most important grasses found in Sal forest,* with the special object of— (*a*) Facilitating the identification of and focussing attention upon those species of most economic value by the publication of descriptions and illustrations; (*b*) Determining the value of the various species as indicators of soils especially suitable for the growth of different forest trees; (*c*) Discovering the best treatment to apply to the grasslands with the object of obtaining the maximum economic return from the grasses. This necessitates a study of their life-history, of the development of the culms and of the effect of different factors such as fire, grazing, etc., on their growth; (*d*) Determining the influence of these grasses on the development of *Sal* seedlings; (*e*) Determining, when necessary in collaboration with other specialists, the economic value of the different species in improving the soil, preventing erosion, as fodder, and in other ways; (*f*) Determining, so far as possible with the assistance of local Forest Officers, the distribution and local vernacular names of the different species.	Ditto ditto.	

Part II.—Miscellaneous Investigations.

1	*Study of the most important forest grasses,* so far as opportunity permits, on the lines adopted for the grasses of *Sal* forests.	Cannot be indicated at present . .	Identification of grasses from Burma and elsewhere already begun.
2	*Systematic Botany.*—This will be continued with special reference to— (*a*) The identification of specimens for Forest Officers;	At Dehra Dun in the Experimental Garden and Herbarium, to be extended on tours; as a rule undertaken primarily in connection with other subjects.	Study already in hand.

Part II.—Miscellaneous Investigations—contd.

Serial No.	Subjects and details of investigation.	Locality of investigation.	Remarks.
	(*b*) The systematic study of species and larger groups of forest plants with the object of enabling Forest Officers to distinguish clearly those forms of most economic importance from others of little value with which they are at present confused. The study of the following genera is now in hand and will be continued until completed: *Grewia, Xylia, Terminalia, Iseilema, Saccharum,* and *Anogeissus.* The study of other genera will be taken up as occasion requires. A study of the forms of *Acacia arabica* and *Cymbopogon Martini* is also in hand and will be continued;		
	(*c*) The description and illustration of those exotics likely to be most valuable in Indian forests with details of the conditions under which they are known to thrive and with the object of preventing waste of money on the introduction of unsuitable species, or on the cultivation of valuable species in unsuitable localities.		
3	*Disease of Pinus excelsa caused by Trametes Pini.*	Punjab	Study already in hand.
4	*Spike disease of Sandal* . . .	Coorg, Mysore and Madras . .	Ditto.
5	*Preparation of revised Botany Manual* (including detailed systematic botany) for the students of Dehra Forest College.	Dehra Dun	Ditto.

C.—Programme of the Forest Economist.

Serial No.	Subjects and details of investigation.	Locality of investigation.	Remarks.
1	A full enquiry into the uses, outturn, market value and mechanical and physical properties of *Cedrus deodara*.	Punjab and United Provinces . .	If the enquiry is completed within three years *DalbergiaSissoo* will be taken up on similar lines.
*2	Utilization of grasses for pulp.		
3	Observation and encouragement of the bamboo pulp industry in India and Burma.	.....	Further inspection of bamboo areas may be necessary.
4	Observation and encouragement of the match industry in India and Burma.		
5	*Antiseptic treatment of timbers*—		
	(*a*) Best methods of treating railway sleepers, constructional timber, telegraph poles, and bamboos;	.....	So far the enquiry has been confined to railway sleepers.
	(*b*) The preservation of tea shooks from insect attack while stored in the sawmills, or tea-garden godowns;	Assam and Bengal	Enquiry already in hand.
	(c) The preservation of timber from the attacks of marine borers.		
6	*Tanning products.*—To ascertain the tanning value of certain mangrove and other barks.	India and Burma.	
*7	*Destructive distillation of Wood*—Enquiries in progress to continue and new enquiries to be made as regards the commercial possibilities of the industry.	.....	The appointment of an expert will probably be necessary after figures of price and outturn for certain localities have been obtained.
8	*Investigation into the physical properties and seasoning power of various timbers.*		
	(*a*) *Sal.*—Mode of seasoning and relative strength of timber felled at different seasons of the year;	Dehra Dun	Already in hand.
	(*b*) *In* and *Kanyin.*—Discovery of a simple method of distinguishing the two timbers.	Ditto.	
	(*c*) The best methods of seasoning timber.	Ditto.	
*9	The finding of markets and new uses for certain timbers.	.....	The issue of bulletins describing the uses and sources and supply of important timbers should be continued.
*10	The uses and possibility of putting on the market of certain gums, resins, and oleo-resins.	.....	With special reference to *Boswellia serrata*.
11	The suitability of certain woods for packing cases with special reference to the following :—		
	(*a*) Bengal and Assam timber suitable for three-ply veneers for tea-boxes (Venestas);	Assam.	
	(*b*) Enquiry into the best methods of packing rosin at the Bhowali and Lahore factories;		
—	(*c*) Central Provinces woods suitable for packing cement;	Central Provinces	Required by a large Bombay firm.
	(*d*) The cause of cheesiness in certain timbers used for tea-boxes.	Dehra Dun	In conjunction with the Forest Chemist.
*12	General enquiry into fibres, their value, and uses.		

* Under this head the specific requests made by Forest Officers have been noted and are receiving careful attention.

C.—Programme of the Forest Economist—*contd.*

Serial No.	Subjects and details of investigations.	Locality of investigation.	Remarks.
*13	General enquiry into the uses and value of oils obtained from grass, seeds, leaves and woods.	Dehra Dun	In conjunction with the Forest Chemist.
14	Woods suitable for — (*a*) Paving blocks. (*b*) Railway rolling stock. (*c*) Railway keys. (*d*) Harbour construction. (*e*) Other miscellaneous uses.		Several of these enquiries are already in hand.
15	The best methods of distillation of pine resins and the finding of new markets for and grading of the finished products.	Dehra Dun, Bhowali, and Lahore .	In conjunction with the Forest Chemist.
16	Observation of the Andamans padauk market.		

* Under this head the specific requests made by Forest Officers have been noted and are receiving careful attention.

D.—Programme of the Forest Zoologist.

Serial No.	Subjects and details of investigation.	Locality of investigation.	Remarks.
*1	The study of all insects which cause serious damage, or which are beneficial to the *Sal* tree or its timber.	United Provinces, Assam, and Bengal	This investigation will be continued.
2	Preparation of a satisfactory reference collection of insects for the Research Institute.	...	Will be continued.
3	Investigations regarding *Lac* insects .	United Provinces, Central Provinces and Bombay Presidency.	These investigations will be continued.
4	Study of the bee-hole borer and the means to prevent or minimize the damage done by it to teak in Burma.	Burma	This and *Lac* are the most important of all the subjects to be investigated. It will be dealt with as soon as opportunity offers.
5	Study of the life-history of *Hypsipyla robusta* attacking Toon trees.	Kangra Division, Punjab . .	Already in progress.
6	Scale insects attacking Chir seedlings in Naini Tal Forest Division.	Naini Tal Forest Division, United Provinces.	
7	Insects attacking Chir and Blue pine in the Chakrata Forest Division, United Provinces.	Chakrata Forest Division, United Provinces.	A preliminary study of these insects has been made. The investigation will be taken up later on.
8	Sisoo and Khair defoliators in Jalpaiguri.	Jalpaiguri Division, Bengal . .	There is already more than enough work on hand, for this reason this subject cannot be dealt with immediately.
9	Sundri borer in the Sunderbans . .	Sunderbans Division, Bengal . .	Already commenced.
10	Study of the life-history and best method of combating attacks of defoliating caterpillars which are the cause of considerable injury to the teak. Ain (*Terminalia tomentosa*) and Dhaura (*Anogeissus latifolia*) in Central Provinces.	...	As for No. 8.
11	Collection of information annually from every province of India regarding insects attacking principal timber-yielding species of the Central Provinces.	...	Information bearing on the insects attacking the chief timber trees is gradually being obtained by the Forest Zoologist for all provinces. It is dependent very largely upon Forest Officers sending in material.
12	Study of the life-history and best method of combating attacks of the beetle (*Coelosterna spinata*) on Babul in Berar.	Berar Circle, Central Provinces .	As for No. 8.
13	Measures connected with the boring of teak seed by insects when on the tree.	Bombay Presidency (Central Circle) .	Ditto.
14	Methods of exterminating the defoliating caterpillars in the Nilambur Teak plantations.	...	Ditto.
15	Spike disease in Sandal wood . .	...	In conjunction with the Botanist.
16	Protection of seeds from insects when stored or freshly sown.	Dehra Dun.	

* Under this head the specific requests made by Forest Officers have been noted and are receiving careful attention.

E.—Programme of the Forest Chemist.

The Forest Chemist will assist members of the Research Institute and other officers asking for his co-operation as may be approved by the President. He is not, as a rule, to initiate independent investigations.

APPENDIX V.

ANNUAL FORM NO. 24.

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE DIVISIONS.

Summary of Revenue of the different Divisions during 1912-13 (Forest Year).

BUDGET HEADS.	President.	Sylviculturist.	Forest Botanist.	Forest Zoologist.	Forest Economist.	Forest Chemist.	TOTAL.
1	2	3	4	5	6	7	8
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
V.—MISCELLANEOUS—							
b. Refunds	...	127 0 0	29 0 0	1 0 0	147 0 0	1 0 0	305 0 0
c. Other sources	...	11 0 0	1 0 0	...	30 0 0	74 0 0	116 0 0
TOTAL V	...	138 0 0	30 0 0	1 0 0	177 0 0	75 0 0	421 0 0
GRAND TOTAL REVENUE	...	138 0 0	30 0 0	1 0 0	177 0 0	75 0 0	421 0 0

Summary of Expenditure of the different Divisions during 1912-13.

VI.—LIVE-STOCK, STORES, TOOLS AND PLANT—							
c. Purchase of stores, tools and plant	5,718 0 0	71 0 0	145 0 0	93 0 0	197 0 0	152 0 0	6,376 0 0
TOTAL A. VI	5,718 0 0	71 0 0	145 0 0	93 0 0	197 0 0	152 0 0	6,376 0 0
VII.—COMMUNICATIONS AND BUILDINGS—							
b. Buildings	4,488 0 0	...	...	...	...	...	4,488 0 0
c. Other works	460 0 0	...	...	...	...	24 0 0	484 0 0
TOTAL A. VII	4,948 0 0	...	...	...	...	24 0 0	4,972 0 0
IX.—MISCELLANEOUS—							
b. Other Charges	1,049 0 0	2,805 0 0	802 0 0	496 0 0	10,209 0 0	2,012 0 0	17,373 0 0
TOTAL A. IX	1,049 0 0	2,805 0 0	802 0 0	496 0 0	10,209 0 0	2,012 0 0	17,373 0 0
TOTAL A.—CONSERVANCY AND WORKS	11,715 0 0	2,876 0 0	947 0 0	589 0 0	10,406 0 0	2,188 0 0	28,721 0 0
B.—ESTABLISHMENTS.							
I.—SALARIES—							
a. Conservators	11,087 0 0	...	...	...	...	...	11,087 0 0
b. Superior Officers	8,562 0 0	12,745 0 0	12,020 0 0	7,085 0 0	11,782 0 0	5,318 0 0	57,512 0 0
c. Subordinate forest and depôt establishments.	...	2,310 0 0	...	...	...	...	2,310 0 0
d. Office establishments	7,359 0 0	3,143 0 0	4,469 0 0	3,414 0 0	2,635 0 0	3,099 0 0	24,119 0 0
e. Deputation and special allowances	7,134 0 0	1,800 0 0	1,970 0 0	...	2,300 0 0	...	13,204 0 0
TOTAL B. I	34,142 0 0	19,998 0 0	18,459 0 0	10,499 0 0	16,717 0 0	8,417 0 0	1,08,232 0 0
II.—TRAVELLING ALLOWANCES—							
b. Superior Officers	57 0 0	2,146 0 0	240 0 0	1,533 0 0	2,320 0 0	237 0 0	6,533 0 0
c. Subordinate forest and depôt establishments.	...	531 0 0	...	...	...	...	531 0 0
d. Office establishments	27 0 0	486 0 0	67 0 0	384 0 0	651 0 0	98 0 0	1,713 0 0
TOTAL B. II	84 0 0	3,163 0 0	307 0 0	1,917 0 0	2,971 0 0	335 0 0	8,777 0 0
III.—CONTINGENCIES—							
a. Stationery	...	92 0 0	72 0 0	24 0 0	13 0 0	35 0 0	236 0 0
b. Carriage of tents and records	...	873 0 0	2 0 0	444 0 0	249 0 0	31 0 0	1,599 0 0
c. Rents, rates and taxes	193 0 0	...	44 0 0	...	...	1,910 0 0	2,147 0 0
d. Pay of police guards	...	...	...	...	...	...	...
e. Official postage	330 0 0	175 0 0	223 0 0	269 0	502 0 0	105 0 0	1,603 0 0
f. Sundries	9,992 0 0	881 0 0	2,208 0 0	1,741 0 0	999 0 0	707 0 0	16,528 0 0
TOTAL B. III	10,515 0 0	2,021 0 0	2,549 0 0	2,477 0 0	1,763 0 0	2,788 0 0	22,113 0 0
TOTAL B.—ESTABLISHMENTS	44,741 0 0	25,182 0 0	21,315 0 0	14,893 0 0	21,451 0 0	11,540 0 0	1,39,122 0 0
GRAND TOTAL OF EXPENDITURE	56,456 0 0	28,058 0 0	22,262 0 0	15,482 0 0	31,857 0 0	13,728 0 0	1,67,843 0 0
SURPLUS OR DEFICIT	—56,456 0 0	—27,920 0 0	—22,232 0 0	—15,481 0 0	—31,680 0 0	—13,653 0 0	—1,67,422 0 0

U. C. BANERJEE,

Chief Superintendent, Office of the Comptroller, India Treasuries.

CALCUTTA,

The 30th August 1913.

Certified that the totals of this form as printed in the Forest College and Forest Research Institute Reports for 1912-13 when added together agree with those entered in the Forms for the combined office as supplied by the Comptroller, India Treasuries, under Article 78 (ii) of the Forest Department Code.

R. S. HOLE,

Offg. President, Forest Research Institute and College.

APPENDIX VI.

FORM NO. 25.—[PRESCRIBED.]

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE, FOREST DIVISION.

Account Current for the Forest Year 1912-13.

RECEIPTS.	President.	Sylviculturist.	Forest Botanist.	Forest Zoologist.	Forest Economist.	Forest Chemist.	TOTAL.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
CASH BALANCE	...	...	...	727 7 11	...	45 13 11	773 5 10
VIII.—ASSESSED TAXES—							
Income Tax—deductions from salaries	...	354 11 5	349 8 6	181 15 0	298 13 5	163 7 5	1,348 7 9
REVENUE DURING THE FOREST YEAR 1912-13.	...	137 13 0	29 12 3	0 14 0	177 1 5	75 0 7	420 9 3
PERSONAL DEPOSITS, LADY MINTO NURSING ASSOCIATION FUND.	...	...	...	...	...	...	...
FOREST ADVANCES	...	5,084 10 3	2,907 12 5	957 13 3	2,101 15 3	165 0 0	11,217 3 2
SUSPENSE ACCOUNT	...	...	...	...	...	0 8 0	0 8 0
SERVICE FUNDS—							
Uncovenanted Service Family Pension Fund, Bengal.	...	...	299 6 0	...	...	...	299 6 0
SAVINGS BANK DEPOSITS—							
Bank Account—							
Forest Officers' Provident Fund	...	270 0 0	...	...	...	...	270 0 0
General Provident Fund	...	1,165 6 3	1,934 12 0	816 12 0	1,462 8 0	...	5,379 6 3
CASH REMITTANCES—LOCAL—FOREST REMITTANCES.							
Forest cheques drawn	18 8 8	274 2 6	1,400 14 9	1,220 11 0	490 0 7	329 6 2	3,733 1 8
EXCHANGE ACCOUNT WITH OTHER GOVERNMENTS.							
Account between India and Burma— III.—Items adjustable by India	...	500 0 0	...	...	...	...	500 0 0
Account between India and Assam— III.—Items adjustable by India	...	...	...	...	550 0 0	...	550 0 0
Account between India and Bengal— III.—Items adjustable by India	...	...	77 8 0	6 14 9	72 2 3	3 10 3	160 3 3
Account between India and United Provinces of Agra and Oudh— III.—Items adjustable by India	56,292 4 6	26,488 13 7	17,625 11 1	12,509 6 6	29,665 7 3	13,277 12 2	1,55,859 7 1
Account between India and Punjab— III.—Items adjustable by India	...	400 0 0	660 0 0	...	...	...	1,060 0 0
Account between India and Madras— III.—Items adjustable by India	...	33 12 0	...	...	0 12 3	...	34 8 3
INTER-DEPARTMENTAL TRANSFERS—							
Military Supply Department	...	54 1 1	40 12 5	11 9 6	4 14 3	...	111 5 3
Telegraph Department	...	...	135 0 0	...	...	...	135 0 0
Post Office Department	...	...	18 6 0	...	...	...	18 6 0
Civil Departments	271 13 0	41 5 6	...	...	...	...	313 2 6
GRAND TOTAL	56,582 10 2	34,804 11 7	25,479 7 5	16,433 7 11	33,723 10 8	14,060 10 6	1,81,084 10 3
PAYMENTS.							
I.—REFUNDS AND DRAWBACKS	...	...	...	...	...	8 5 4	8 5 4
EXPENDITURE DURING THE FOREST YEAR 1912-13.	56,582 10 2	28,058 4 0	22,262 1 11	15,482 3 1	31,856 8 1	13,727 14 2	1,67,969 9 5
II.—FOREST—GENERAL DIRECTION—INSPECTOR GENERAL, FORESTS, SALARIES.	...	211 9 9	...	...	...	...	211 9 9
FOREST ADVANCES	...	5,238 4 6	3,164 8 3	922 2 3	1,690 1 2	165 0 0	11,180 0 2
SUSPENSE ACCOUNT	...	...	...	...	...	0 8 0	0 8 0
EXCHANGE ACCOUNT WITH OTHER GOVERNMENTS—							
Account between India and Burma— IV.—Items adjustable by Burma	...	758 12 4	...	...	...	...	758 12 4
Account between India and United Provinces of Agra and Oudh— III.—Items adjustable by India	...	13 7 0	36 2 3	0 2 8	147 1 5	75 0 7	271 13 11
Accounts between India and Madras— III.—Items adjustable by India	...	10 6 0	...	...	...	...	10 6 0
INTER-DEPARTMENTAL TRANSFERS—							
Military Supply Department	...	114 0 0	...	...	30 0 0	...	144 0 0
Civil Departments	...	...	16 11 0	...	...	...	16 11 0
CASH BALANCE	...	400 0 0	...	28 15 11	...	83 14 5	512 14 4
GRAND TOTAL	56,582 10 2	34,804 11 7	25,479 7 5	16,433 7 11	33,723 10 8	14,060 10 6	1,81,084 10 3

U. C. BANERJEE,
Chief Superintendent, Office of the Comptroller, India Treasuries.

CALCUTTA;
The 30th August 1913.

Certified that the totals of this form as printed in the Forest College and Forest Research Institute Reports for 1912-13 when added together agree with those entered in the forms for the Combined Office as supplied by the Comptroller, India Treasuries, under Article 78 (ii) of the Forest Department Code.

R. S. HOLE,
Offg. President, Forest Research Institute and College.

APPENDIX VII.

ANNUAL FORM NO. 27.—[PRESCRIBED.]

FOREST DEPARTMENT, INDIA, FOREST RESEARCH INSTITUTE DIVISIONS.

Outstandings and Liabilities on account of Contractors and Disbursers for Forest Year 1912-13.

Division.	DEPARTMENT DEBTOR.			DEPARTMENT CREDITOR.			BALANCE DUE.
	At commencement of year.	Recoveries in cash and value of supplies and work done during the year.	At close of year.	At commencement of year.	Payments made during year.	At close of year.	To Department (Outstandings).
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Sylviculturist	...	5,084 10 3	5,084 10 3	455 13 9	5,238 4 6	5,694 2 3	609 8 0
Forest Botanist	...	2,907 12 5	2,907 12 5	7 7 3	3,164 8 3	3,171 15 6	264 3 1
Forest Zoologist	...	957 13 3	957 13 3	56 11 0	922 2 3	978 13 3	21 0 0
Forest Economist	...	2,101 15 3	2,101 15 3	598 13 6	1,690 1 2	2,288 14 8	186 15 5
Forest Chemist	...	165 0 0	165 0 0	...	165 0 0	165 0 0	...
TOTAL	...	11,217 3 2	11,217 3 2	1,118 13 6	11,180 0 2	12,298 13 8	1,081 10 6

U. C. BANERJEE,
Chief Superintendent, Office of the Comptroller, India Treasuries.

CALCUTTA;
The 30th August 1913.

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